July
1933

Construction Methods

Concreting Pine Canyon dam, California, with cableway bucket and vibrating equipment

McGraw-Hill
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Construction Methods

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WILLARD CHEVALIER, Publishing Director

Construction Faces a New Order

• Under the administration of the National Industrial Recovery Act the construction industry must be prepared to face a new order of operating conditions. All industry is destined soon to function under government-sanctioned and supervised codes of fair competitive practice. These codes, of course, will vary in the details of their texture, according to the type, size and geographical location of the activities they govern, but woven into all of them will run the basic threads of shorter working hours and minimum wages, to the end that work may be distributed among the maximum number and that pay may be sufficient to insure a decent scale of living instead of a bare subsistence.

While no code of fair construction practice has, as yet, been offered for approval, one is in the making, under the sponsorship of the Associated General Contractors of America. Under its provisions, whatever they may be, changes in current practice are inevitable. Construction will be geared to a new set of working conditions. The contractor is certain to come to grief who is not alert in revising present plans and shaping future methods of procedure to fit the changing trend.

Code of Fair Construction Practice

• At Chicago last month a tentative code of fair competitive construction practice was presented for discussion by representative contractors at a meeting called in behalf of the industry by the Associated General Contractors of America. While the code is not in final form for submission to the Administrator for Industrial Recovery at Washington progress has been made in formulating its general provisions. In view of the differences in industrial and working conditions in various parts of the country and in different kinds of construction work, the plan, as thus far developed, is to establish a master code embodying only general provisions of nation-wide application, to be supplemented by individual regional or class codes, dealing specifically with special or local conditions.

On the important question of a limit on working time the proposal is for 150 hours per calendar month, instead of a weekly or daily maximum, in order to give flexibility for adaptation to weather and work conditions. The recommendation of the meeting was that minimum wage scales, under the provisions of the Industrial Recovery Act, be fixed by the Federal Public Works Administration.

For code administrative purposes and for organizing local and class-of-work programs there will probably be a recommendation that the country be divided into zones or districts. In carrying out the provisions of any adopted code the plan is to organize a national industrial executive committee comprising representatives of the A. G. C. and of non-member contractors. State committees would be formed to deal with disputes under the code and to pass upon matters referred to them by the code committees of local organizations.

Bishop, in The St. Louis Star and Times

Headed for the King-pin

THE greatest peace-time program of public works construction that the United States or any other nation has ever developed by concerted effort, was launched last month when President Roosevelt signed the National Industrial Recovery Act. The new act, providing for the expenditure of $3,300,000,000 on federal, state and municipal projects as an emergency measure for unemployment relief and industrial rehabilitation, marks the dawn of a new day for the construction industry.

Already allotted and now being put to work is the sum of $400,000,000 specifically ear-marked for highway construction, an outright grant to the states entailing no local matching of funds or other restrictions to prevent immediate award of construction contracts. On the heels of this outlay additional millions will be made available for federal, state and local projects, covering a wide range in size, location and type of work, as soon as the organization of the newly created Public Works Administration is perfected. Approval and direction of all local projects, other than highways, will be decentralized under state administrators with wide power. Their early appointment, expected momentarily but officially unannounced at this writing, will pave the way, through construction, toward the primary objective of the New Deal—putting jobless men to work.

An Opportunity for Reform

• Outstanding among reforms to be effected by any code of construction practice are elimination of the pernicious and widespread practice of "bid peddling," restriction of competition to prequalified bidders and the guarantee of fair treatment and a decent minimum wage to labor. In issuing the call for the meeting to consider a construction code at Chicago last month, President Arthur C. Tozzer, of the Associated General Contractors, emphasized that in an industry as complex as construction there are problems which are distinct in each of the major classifications, such as highway, building, public works and railroad construction. It is anticipated that each of these occupational groups may find it desirable to amplify a general master code to cover their own special problems. The tentative draft of the construction code, however, contains the basic principles of fair competition which should govern the general contracting business and which must be included in any code calculated to improve materially labor and competitive conditions in construction, as contemplated by the National Industrial Recovery Act.

A Need For Promotional Effort

• Present indications are that approximately $2,000,000,000 of the $3,300,000,000 appropriated through the National Industrial Recovery Act are to be available for local public improvements. This fact places an immediate responsibility on local public officials, engineers, architects, general contractors and others identified with the construction industry, if this vast sum is to be utilized speedily for increasing employment and stimulating business.

Provisions of the act making available an outright grant of 30 per cent of the cost of such local work also require that the responsibility for repayment of 70 per cent of the cost must be assumed by the local communities. In many instances, this will require that authorization must be secured from legislative bodies, from taxpayers or from administrative officials empowered to enter into such financing agreements. It means that a consistent program of promotional effort must be drawn up in all local communities throughout the country to select the projects, see that the proper authorizations are made and in general get the machinery in motion for making the applications to the Public Works Administration, so that the funds may be secured and work begun immediately.

If Each But Do His Share

SINCE the June issue of this journal the National Recovery Bill has been enacted into law and the public works program now is an essential part of the administration drive for industrial recovery.

During recent months we have debated at length the wisdom of this policy. Every argument for and against it has been advanced, considered, accepted or rejected. Now we have made our decision; the time for discussion is past. The duty of each American now is to do his utmost to make the program successful.

Each of the several groups involved is under some special obligation:

Upon the state governments, for example, it is incumbent to get started at once on the highway construction made possible by the special appropriation for that purpose. The states, moreover, can stimulate and coordinate helpfully the construction projects of their various departments and political subdivisions.

Counties, cities, towns and improvement districts should prepare and submit without delay their plans for useful and necessary public works that may have been suspended because of business conditions. To them this obligation brings a compensating opportunity. They now can build these facilities for the service of their citizens at low cost and under most advantageous financial terms. At the same time they can help materially to reduce the burden imposed by a steadily increasing roll of dependent unemployed.

Manufacturers, contractors and others who do business in the public works field can help materially through their sales, advertising and other promotional activities, to broadcast information as to how local authorities may enlist the funds made available by the recovery act for the benefit of their communities.

Associations of public officials and engineers can, through their sections and individual members, stimulate needed improvement projects. Already the waterworks field has set an example in the cooperative effort of its professional and manufacturers' associations.

Upon the federal officials rests the grave responsibility to perfect speedily the organization needed to administer the President's program and to do this without demoralizing concession to political considerations. The vital need is for honest and intelligent selection of projects and for effective action that will insure the prompt conversion of the appropriations into widespread employment and purchasing power.

Basic Obligations

Upon all these groups rest certain obligations, among them the following:

1 To see that the projects undertaken are sound and useful and ready for early execution.

2 To specify normal and efficient methods and practice, so that the cumulative effects may reach back into the mills, shops, quarries and factories that produce the materials and equipment normally employed in construction operations.

3 To carry on the work through regular construction organizations, so that every element in the structure of the industry may feel the quickening impulse that will start us on the march back to general prosperity.

4 To avoid cut-throat buying and other chiseling practices that would tend to exploit either labor or employers and thereby defeat the major purpose of the effort, which is to revive the will and release the power to purchase over a broad front.

5 First, last and all the time, to act quickly and decisively, so that full advantage may be taken of the present turn for the better in business conditions.

THIS turn is based largely upon a reawakening of hope and confidence. Much of the current activity is speculative, in contemplation of higher prices, either artificially stimulated or based on the expectation of improvement yet to come. If these advances are to be sustained, it is imperative that they be supported by a substantial body of real purchasing power. To effect this is the purpose of the public works program.

The fight against depression has often been likened to a war. In every battle there comes a crucial moment when the opposing forces waver, yield or show other signs of breaking. At that moment the skillful commander throws in his last man and his last gun to clinch a decision.

Today this moment has come. There is an upturn in the spirit of the people. With the rise in prices and values born of that spirit, the President now would throw into the balance the decisive weight of the vast purchasing power made available by the public works act. The moment is well chosen. Victory will depend wholly on the resolution and energy with which each man performs his share of the task.

Gilbert Chevalier

Publishing Director

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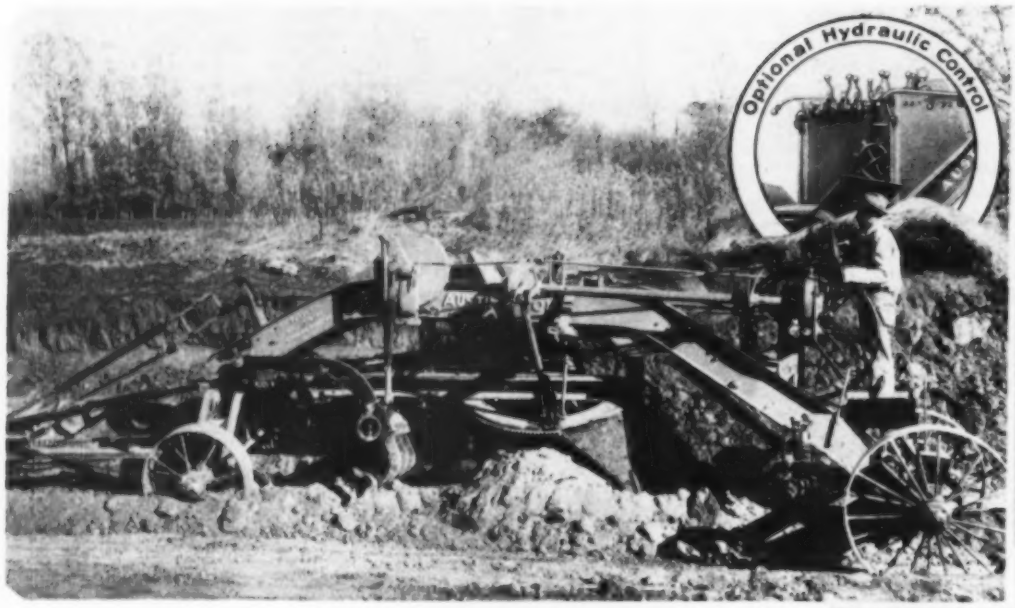
These new PERFORMANCE RECORDS radically lower earth moving costs



Will you be under-bid by new 1933 savings?

Left: For heavy grading jobs at higher speeds, the new Austin No. 12 Grader, with either hydraulic or manual control, has proven itself supreme. Instant operation of blade and scarifier adjustment, steering, wheel leaning, and axle shift eliminates delay and greatly increases cutting speed.

Below: Measure shovel capacity by "Yards per Hour." The easy portability and high speed operation of the Austin Badger Convertible Shovel enables it to do more work per day than many machines far more costly to own and operate.

You may actually save money by laying up one of your present machines and replacing it with the Badger.

Get this data before estimating costs!

It is no longer safe to submit bids for earth moving work on the basis of former grading machinery performance. Important improvements offered by 1933 Austin-Western road machinery have enabled entirely new standards of performance to be set.

Do not take the chance of losing profitable jobs to competitors who have taken advantage of these important savings. Get in touch with your nearest Austin-Western branch office for this data on new lower earth moving costs.

Left: Important improvements introduced in the "77" Motor Grader make it an all around contractors' machine. Formerly regarded only as a maintenance tool, such features as a new wide front axle, a six-speed transmission, positive traction on all drive wheels, and hydraulic controls have made possible its use for oil mixing, sub-grade building, ditch work and graveling.

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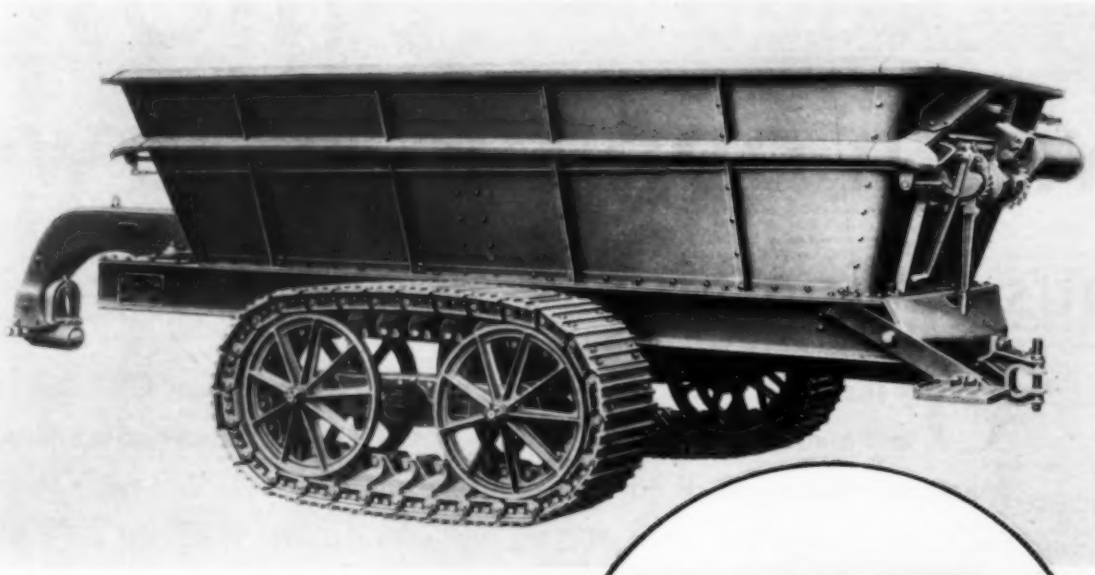
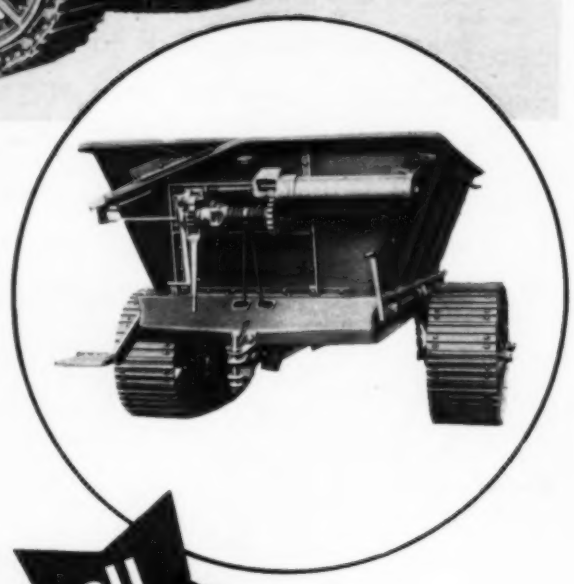
Here's the All-Star ANNOUNCEMENT OF 1933

The NEW ATHEY Forged-Trak 12-YARD Bottom Dump Trailer





NEW dumping flexibility with the Athey Hand-Automatic Dump Mechanism — operating either automatically, semi-automatically, or by hand. That means perfect handling of any material under any operating conditions.

Every feature you have ever wanted in a bottom dump trailer is in this new Athey Forged-Trak! Amazing advantages — exclusive engineering — put it far ahead of anything else on the market today. Athey — always a pioneer — has taken another spectacular forward step in bottom dump trailer construction.

Before you buy any other trailer equipment, investigate the new Athey Forged-Trak Bottom Dump Trailer. You've never seen its equal for light running . . . absolute dependability in every detail . . . utmost efficiency and economy in every operation performed. The new Athey Forged-Trak is THE answer to lowest dirt-moving costs today!

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ATHEY Forged-Trak

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Hand-Automatic Dump Mechanism — new drawbar jack, mounted in rear, mechanically equalizes weight for easy coupling and uncoupling — full cushioned floating drawbar obtained by double-acting spring mounted hitch — spring-mounted cable equalizer — *sealed* track pin bearings — full floating replaceable lock pins in track — positive self-cleaning track assembly — absolutely rigid track structure — extra strength and sturdiness in every part.

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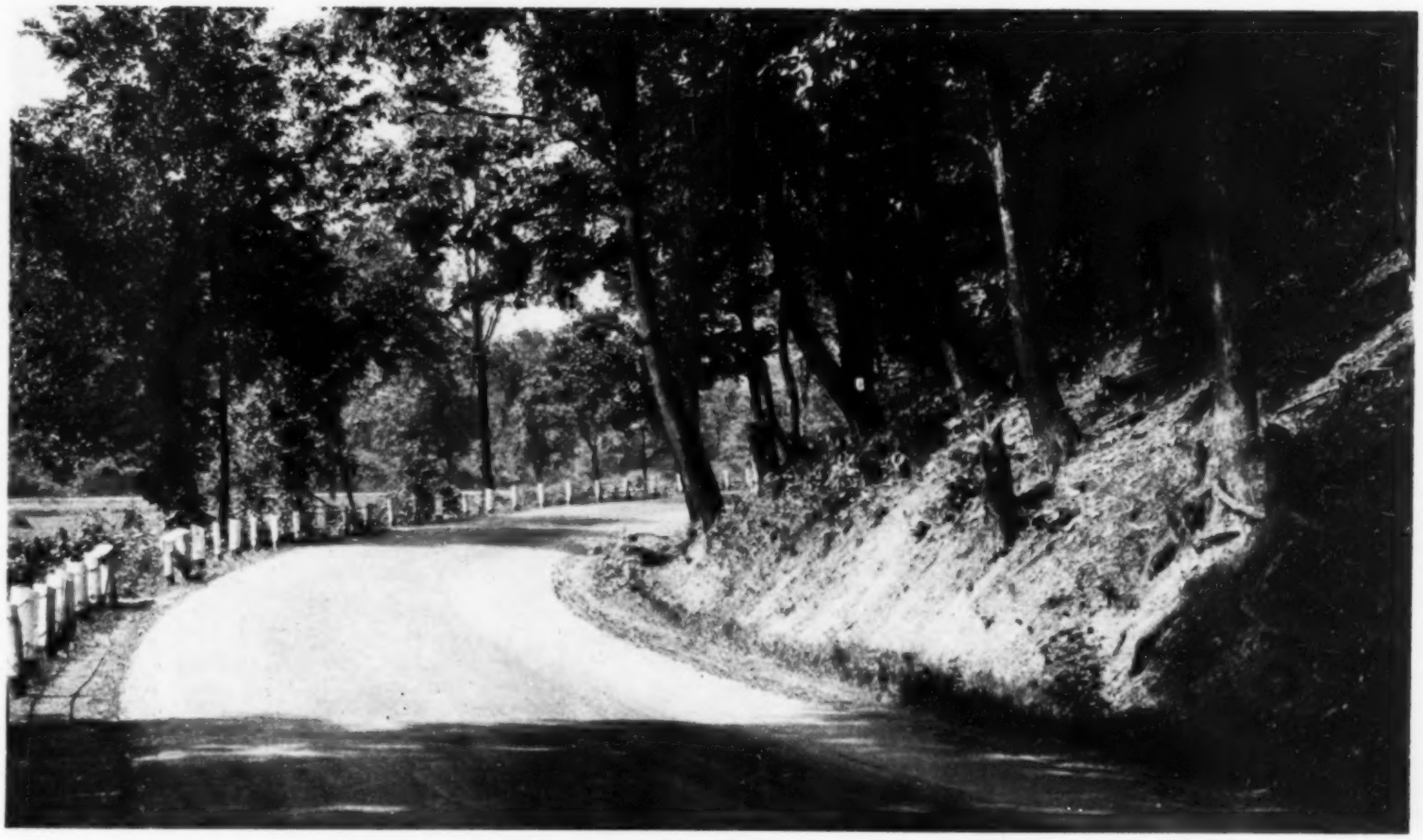

Midland Trail, near Ashland, Kentucky. Tarvia-built, 1921.

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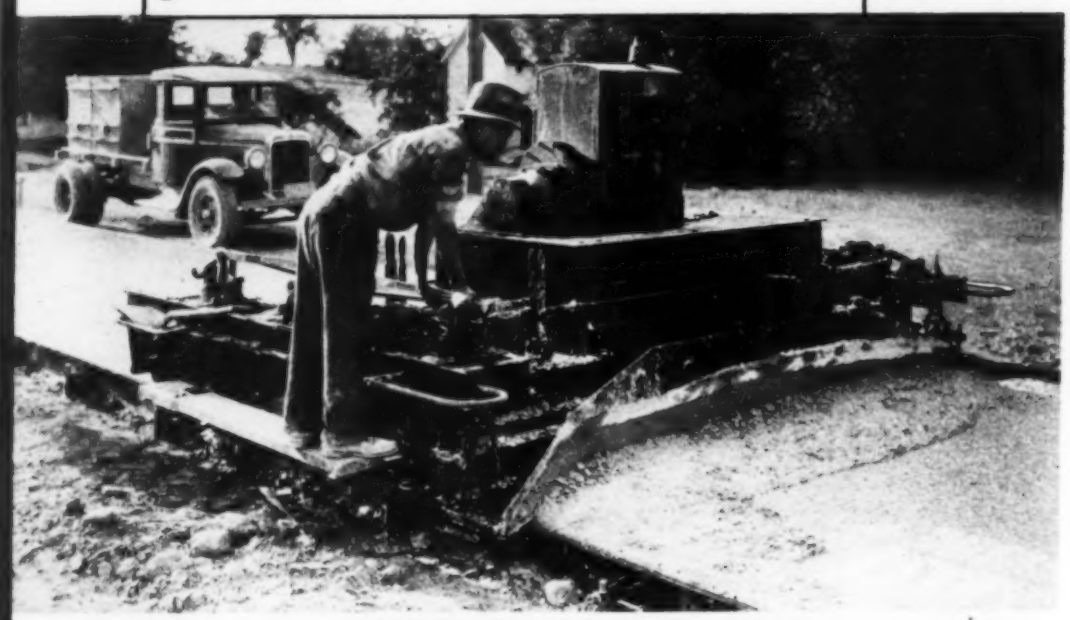

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Mobile, portable plants for large tonnage production. Developed to the last notch of efficiency.

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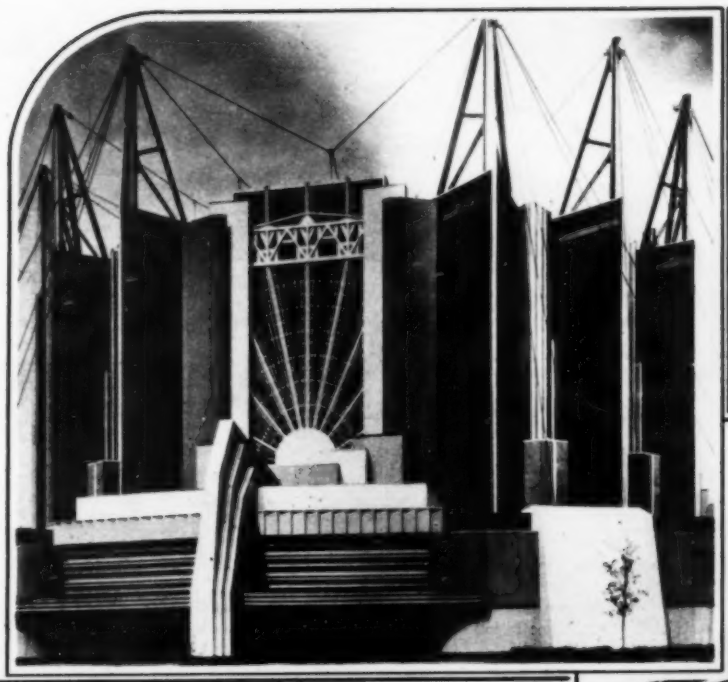
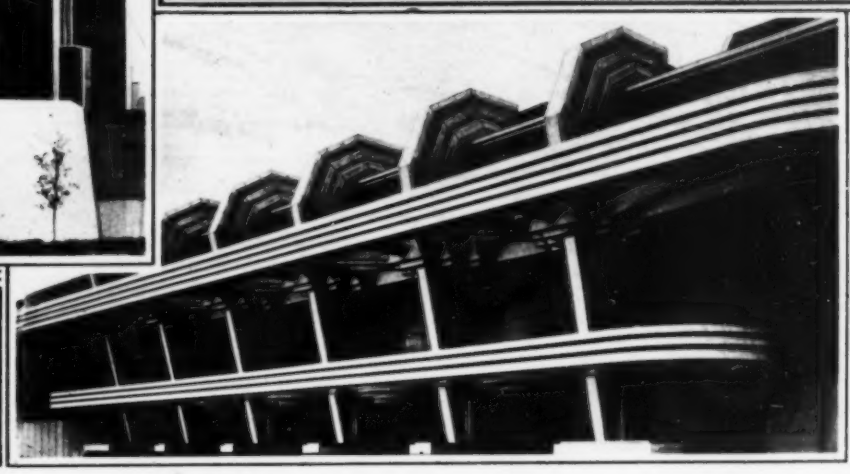


American Steel & Wire Company Wire Rope supports the "Sky-Hung" Dome of the Travel & Transport Building.

American Quality Cold Rolled Strip Steel beautifies the exterior of the same structure.



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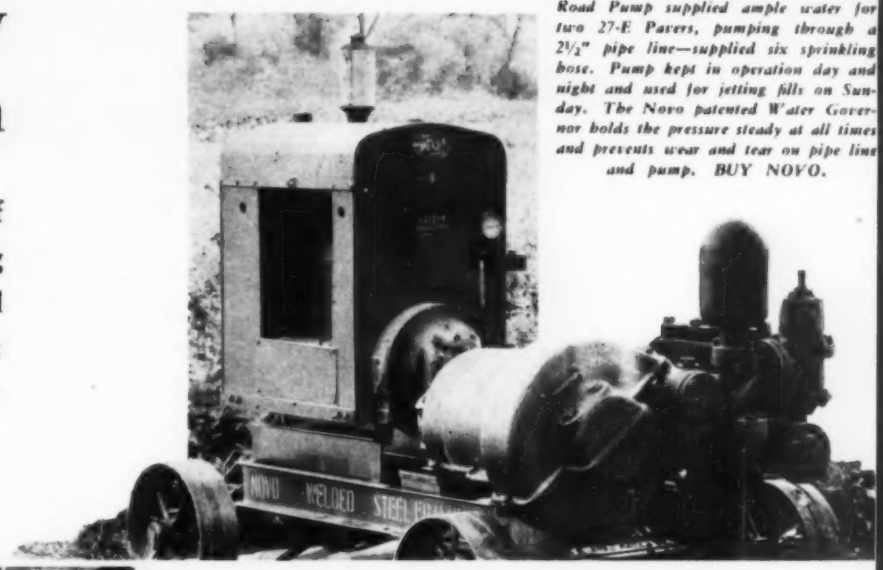
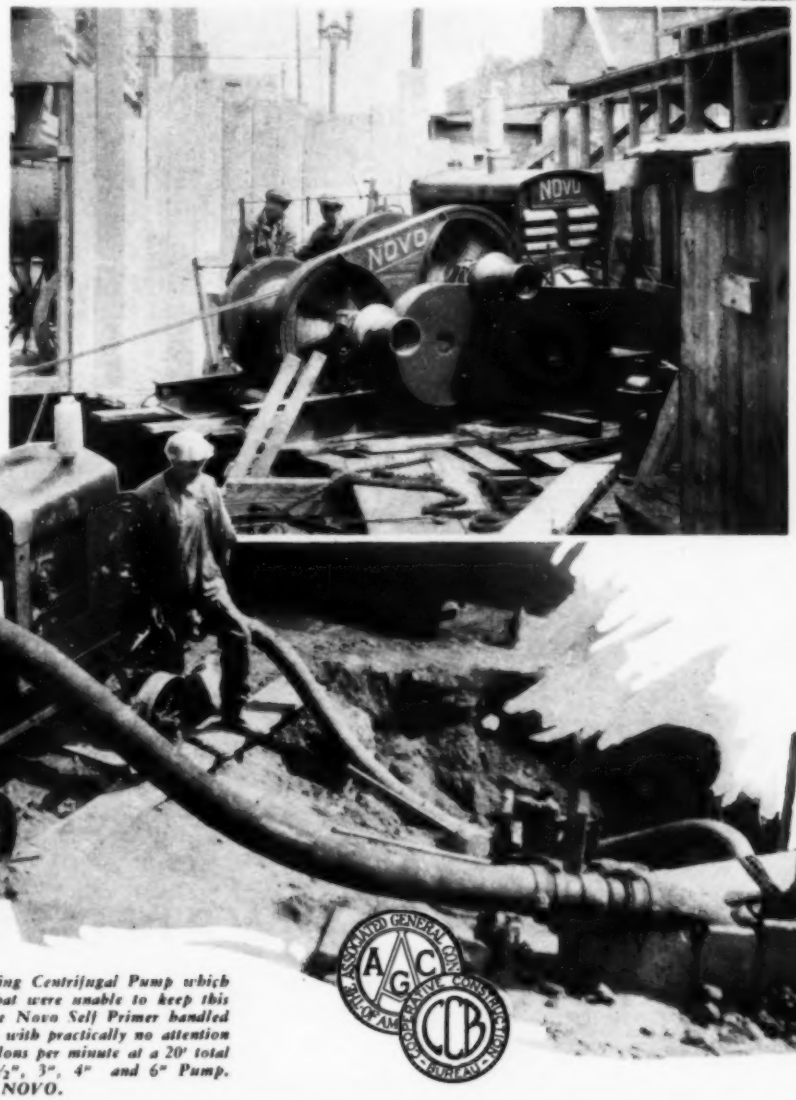


This user reports that his Novo Triplex Road Pump supplied ample water for two 27-E Pavers, pumping through a 2½" pipe line—supplied six sprinkling hose. Pump kept in operation day and night and used for jetting fills on Sunday. The Novo patented Water Governor holds the pressure steady at all times and prevents wear and tear on pipe line and pump. BUY NOVO.



Novo two-drum heavy duty hoist used on this job for placing steel. The girder being placed weighs 60,240 lbs. and is 50 feet long. All drum shafts and thrust bearings are of the roller bearing type. The frame is of welded structural steel.

There is a complete line of Novo Hoists from 2 to 150 Horse Power. Put one to work. BUY NOVO.

Below: This is the cheapest way to take out sand and gravel: The Novo Dragline way. One man is operating this hoist and 1 yard bucket, (lines are run from hoist levers to operator's platform) which is taking out 600 cu. yds. of aggregate a day. A set-up that is easy to build and simple to operate—The investment is low. One man can excavate over any distance up to 400 ft. up hill or down—or from under water. All sizes up to 3 cu. yard capacity. BUY NOVO.

It's a Novo 6" Self Priming Centrifugal Pump which replaced two 4" pumps that were unable to keep this sewer excavation dry. The Novo Self Primer handled the job at less expense and with practically no attention —Pump delivered 1150 gallons per minute at a 20' total head. There is a 2", 2½", 3", 4" and 6" Pump. BUY NOVO.

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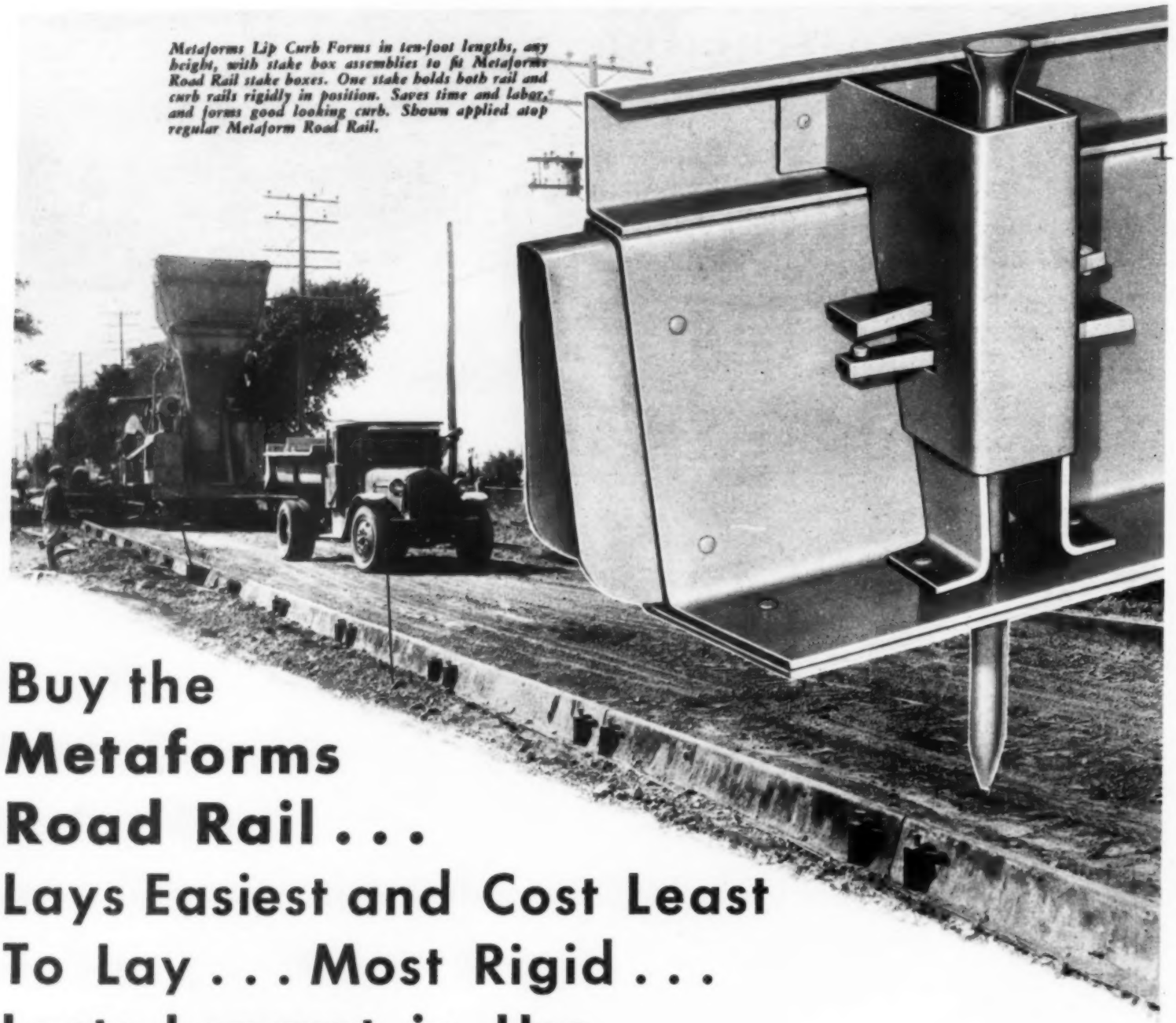

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MILWAUKEE, WIS.

Construction Methods

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ROBERT K. TOMLIN, Editor

Volume 15—Number 7—New York, July, 1933

ROLLED CONCRETE

Makes Stronger Pavement With Lean Mixes

COMPACTION of concrete pavement with a power roller was tried experimentally in Sheboygan County, Wis., last year to determine the effect on the strength of the concrete, particularly where lean mixes were used. Under the supervision of George W. Langlev, Jr., engineer in charge for the state highway commission and for the county, and with the cooperation of the division of management, U. S. Bureau of Public Roads, alternate sections about 1,200 ft. long of rolled and unrolled concrete were laid on one part of a 10-mi. project. Each rolled section placed in 1 day of two 6-hr. shifts was followed by a day's run containing an equal proportion of cement finished in the ordinary way.

Cores taken from the alternate sections and broken after 28 days indicate higher strengths for rolled concrete containing 3.5, 4.0, and 4.5 bags per cubic yard. For richer mixes, containing 5.0, 5.5 and 6.0 bags per cubic yard, no gain in strength as a result of rolling was revealed by the 28-day tests. Additional cores were to be broken at the end of 6 months.

On the rolled concrete sections, two finishing machines were used. One finisher, in front of the roller, struck off the concrete ⅝ to ¾ in. above final grade to allow for compaction. It is Mr. Langley's belief that this operation could be performed as well by a planer, similar to a subgrade planer,

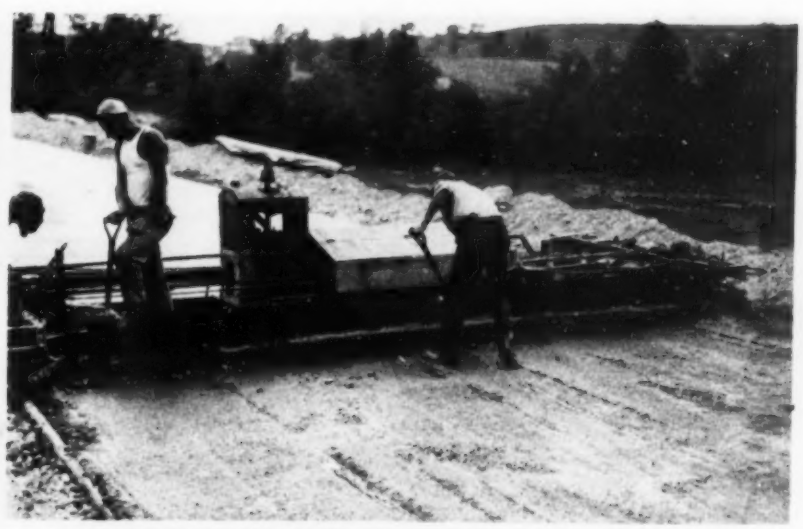
5-TON TANDEM ROLLER *(left)* following first finishing machine compacts concrete pavement in Sheboygan County, Wis. Second finishing machine completes surfacing of pavement.

riding on the forms and attached by cable to the mixer. This arrangement would dispense with the forward finishing machine.

Behind the first finisher, a 5-ton tandem roller compacted the concrete. A second finishing machine followed the roller, striking off the surface to finished grade. No difficulty was experienced in completing the rolled sections on schedule. A total of 7,537 lin. ft. of rolled pavement 20 ft .wide, aggregating 16,733 sq.yd., was laid at an average rate of 104.7 lin. ft., or 232.2 sq.yd., an hour. It is impossible to discern by eye the starting and ending points of the rolled sections, as their surface appearance is the same as that of the rest of the project.

Tests of the 28-day cores gave the following average compressive strengths in pounds per square inch: 3.5 bags of cement per cubic yard, rolled- 3,502 lb., unrolled- 2,857 lb.; 4.0 bags, rolled- 3,497 lb., unrolled- 3,031 lb.; 4.5 bags, rolled- 4,199 lb., unrolled- 3,814 lb. Cores taken from sections having 5.0, 5.5, and 6.0 bags per cubic yard gave somewhat higher strengths for the ordinary concrete than for the rolled concrete.

FIRST FINISHING MACHINE strikes off concrete ⅝ to ¾ in. above final grade to provide for compaction under roller.

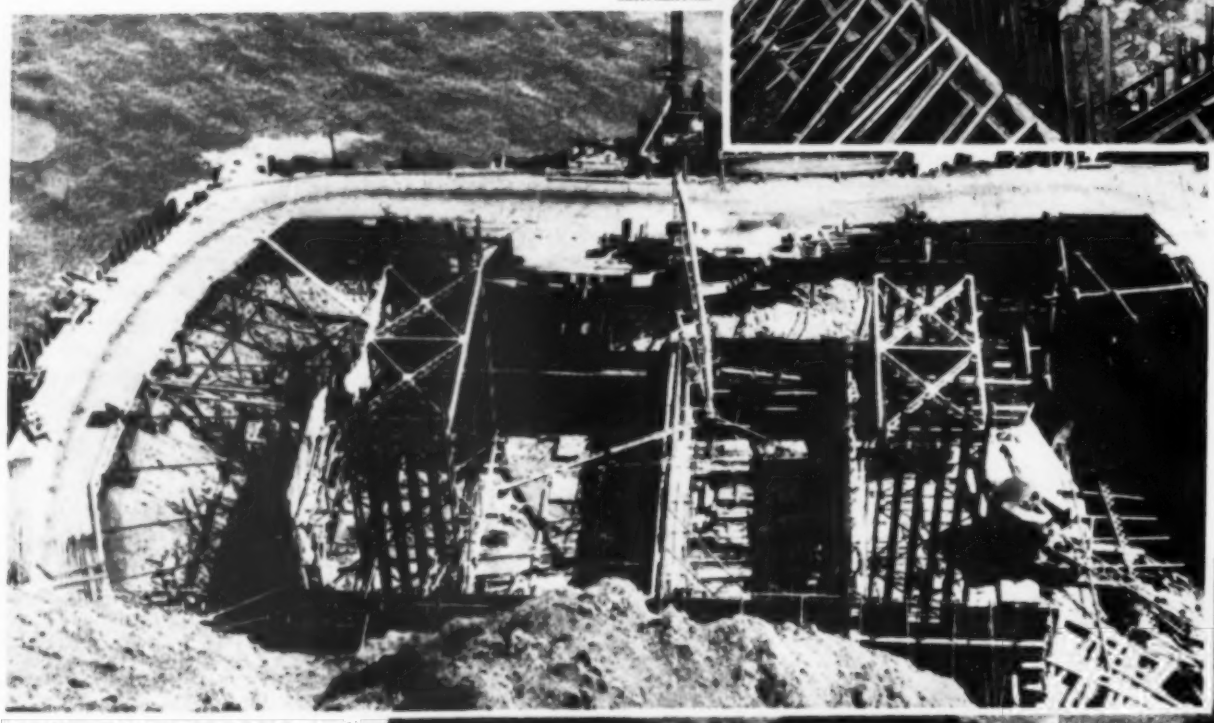


SECOND FINISHING MACHINE provides surface smoothness and texture equal to those obtained by ordinary finishing.

This Month's "NEWS REEL"

International

FIRST BUCKET-LOAD OF CONCRETE was dumped into foundations for Boulder dam in Black Canyon of Colorado River last month, after more than two years of preliminary work by Six Companies Inc. Concrete yardage in U. S. Bureau of Reclamation's 730-ft. high structure will total 3,500,000.



International

NORTH PIER FOR GOLDEN GATE BRIDGE, San Francisco, *(above)* rises within three-sided cofferdam of steel sheetpiling, rock embankment and timber crib. Concrete for base block of Marin County pier, 80x160 ft. in plan, is delivered by 4-yd. transit-mixers and chuted to place from 100-ft. Insley tower equipment.

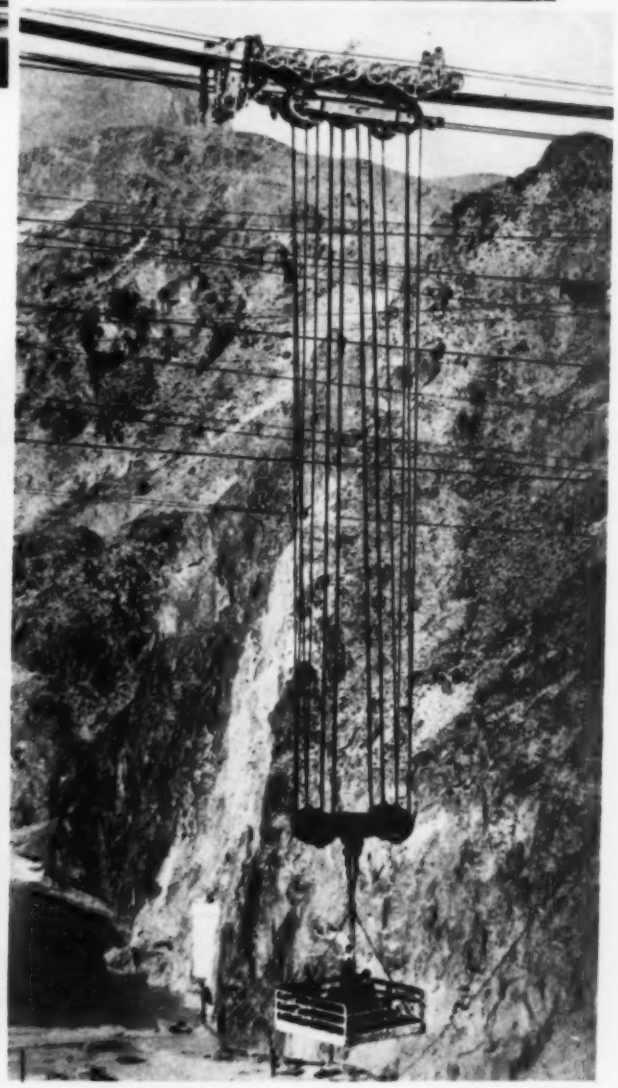
CIVILIAN CONSERVATION CORPS WORKERS, *(right)* recruited under emergency measure to relieve unemployment, build road at Lancaster, Calif., as preliminary to reforestation operations.

Keystone

LAUNCHING $3,300,000,000 PUBLIC WORKS PROGRAM *(left)* Special Board for Public Works meets for first time in Washington, June 19 with Col. Donald H. Sawyer (third from right), appointed temporary Public Works Administrator under Recovery Act. *(Left to right)* Col. George R. Spalding, who directed preliminary organization of Public Works Administration; Turner W. Battle, representing Secretary of Labor Perkins; George H. Dern, Secretary of War; H. L. Ickes, Secretary of the Interior; Oscar L. Chapman, Assistant Secretary of the Interior; Col. Sawyer; L. W. Robert, Assistant Secretary of the Treasury, and R. O. Kloeber, Bureau of the Budget.

Wide World SIGNING INDUSTRY'S MAGNA CHARTA. President Franklin D. Roosevelt, on June 16, approves National Industrial Recovery Act, carrying a $3,300,000,000 public works program to provide jobs for the unemployed and renew industrial activity under codes of fair competitive practice. *(Standing, left to right)* Senators Robinson and Wagner and Congressmen Doughton, Ragon, Hill and McClintic.

AT CLE ELUM DAM, on U. S. Bureau of Reclamation's Yakima Project, in Washington, Winston Bros. Co., contractor of Minneapolis, is placing fill in 1,235,000-cu. yd. earth and gravel embankment 750 ft. long and 135 ft. in maximum height above streambed. View is looking downstream over embankment.



GIANT CABLEWAY, spanning canyon of Colorado River, is placed in operation to serve Boulder dam, on which concreting was begun last month.

Vibrated No-Slump Concrete Placed in

PINE CANYON DAM

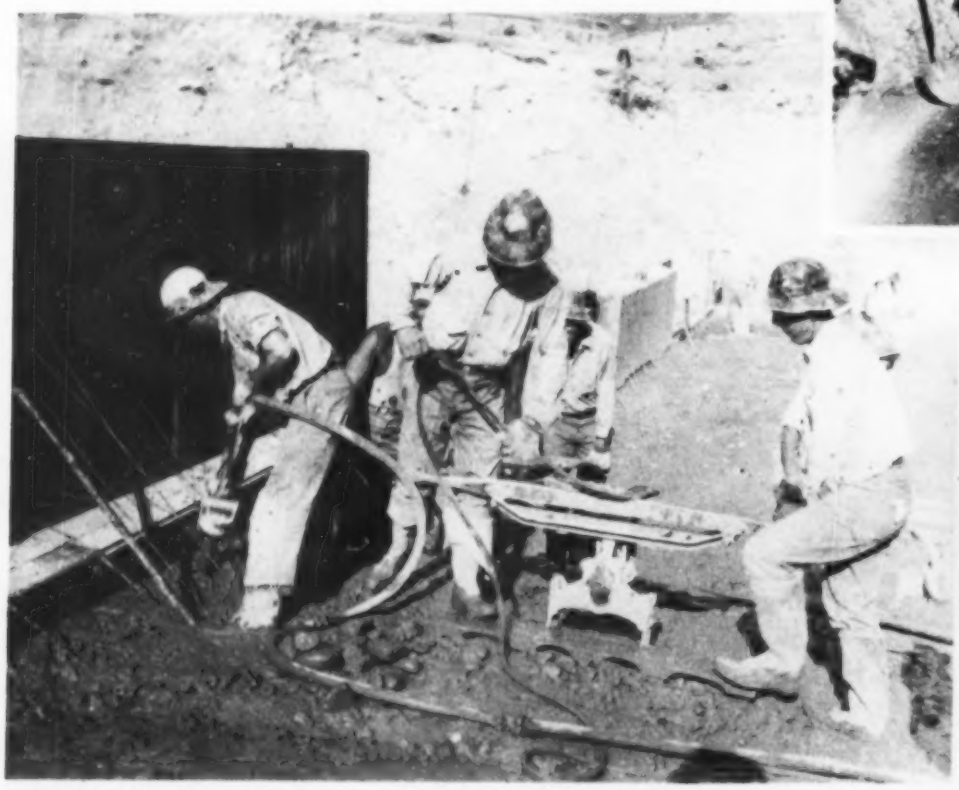
MODERN mass-concrete practice, including both equipment used and methods of handling, is exemplified by the present operations of the joint contracting organization, Bent Brothers, Inc., Winston Bros., and Wm. C. Crowell, at Pine Canyon dam, being built for the Water Department of Pasadena, Calif., on the San Gabriel River. The dam will store 40,000 acre-ft. to augment the present municipal water supply of Pasadena, now obtained from wells, and will ultimately form an important distribution reservoir on the Colorado River aqueduct system of the Metropolitan Water District. Features of construction procedure which indicate the trend of modern practice include: transportation of aggregate by aerial tramway, handling of concrete by buckets on cableways, use of a "no-slump" mix and placement of concrete with the aid of vibrators.

Design of Dam—The dam is of gravity design, 240 ft. high above streambed, and will contain 440,000 cu.yd. of concrete. A fault crosses the site in the streambed parallel to the flow of the river and has necessitated special provision in the design to allow for the possibility of movement. This design feature did not affect the general concreting procedure. The straight streambed section is flanked at either end with slightly curved wings, the total crest length being 750 ft. A spillway is provided through a deep cut near the west abutment and will be equipped with three radial gates. Withdrawals from the reservoir will be conveyed by an 18-mi. pipe line 40-in. in diameter to connect with the present municipal water supply system.

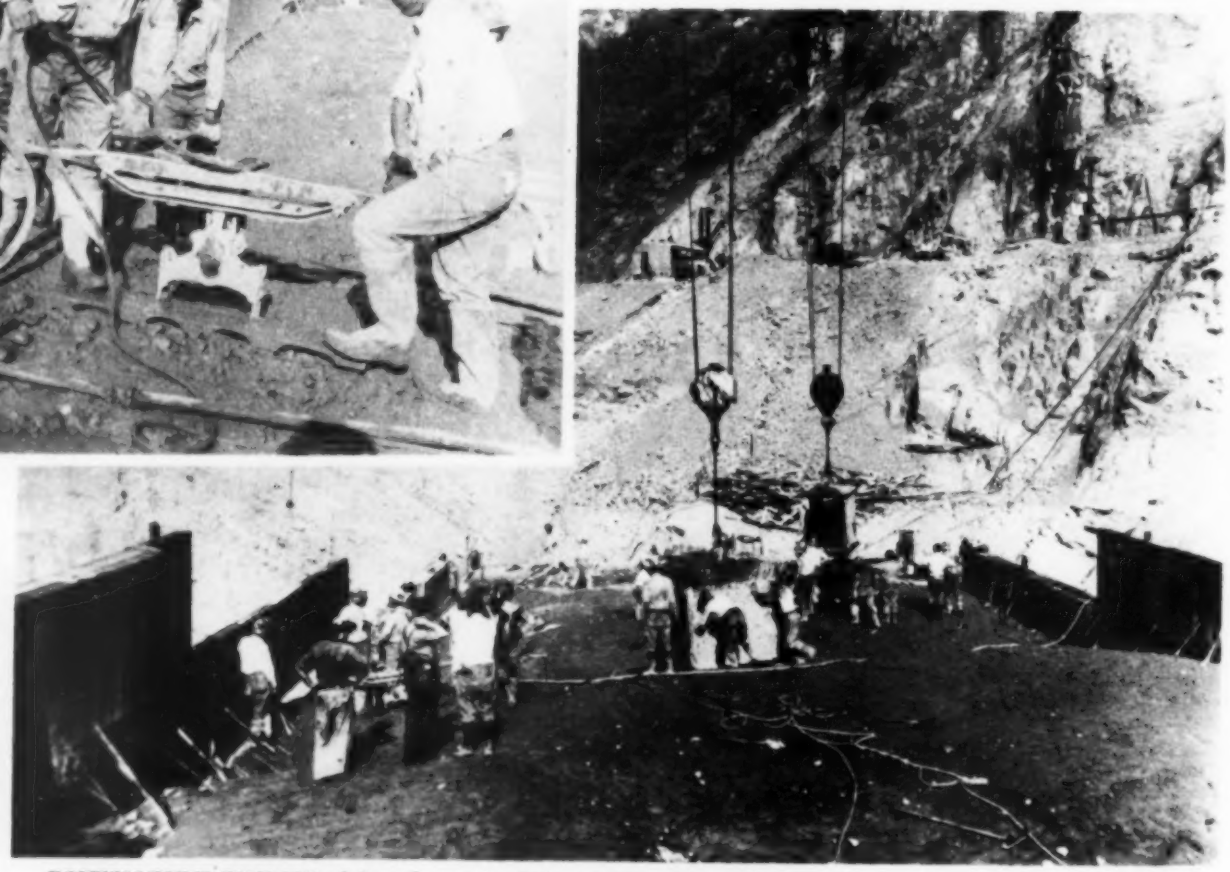
Aerial Tramway — Aggregate, including sand and four grades of coarse aggregate, is brought to the site by a 2-mi. American Steel & Wire Co. tramway. The lower end of this tram is the terminal of a 2-mi. railroad haul from a commercial gravel pit. The aggregate is stockpiled at this transfer point and handled by belt conveyor to the bunkers over the tram terminal.

Supports for the tramway consist of fifteen timber towers, including one double-tension station providing a 28-deg. horizontal angle, and the terminals. Buckets of about 1¼-cu.yd. capacity travel at a 210-ft. spacing and are electrically dispatched at regular intervals. The capacity of the tram is 225 tons per hour. The track cable is of locked-coil design, 1⅝ in. in diameter on the loaded line and 1 in. in diameter for the return. A tension of 17,000

CLEANING UP before starting next lift of concrete. Surface is thoroughly flushed with air and water before new concrete is deposited from cableway buckets.



VIBRATORS in form of spades and platform machines assist placing of dry "no-slump" concrete.



BOTTOM-DUMP BUCKETS of 4-cu.yd. capacity deliver concrete from cableway to place. Concrete is placed in 5-ft. lifts.

ORIGINAL STYLE of 4-yd. bucket, before it was redesigned to be self-closing. Two men open gates and ride bucket on upswing, dropping off on return dip.

VERNE PEUGH *(below)*, resident engineer on Pine Canyon Dam.

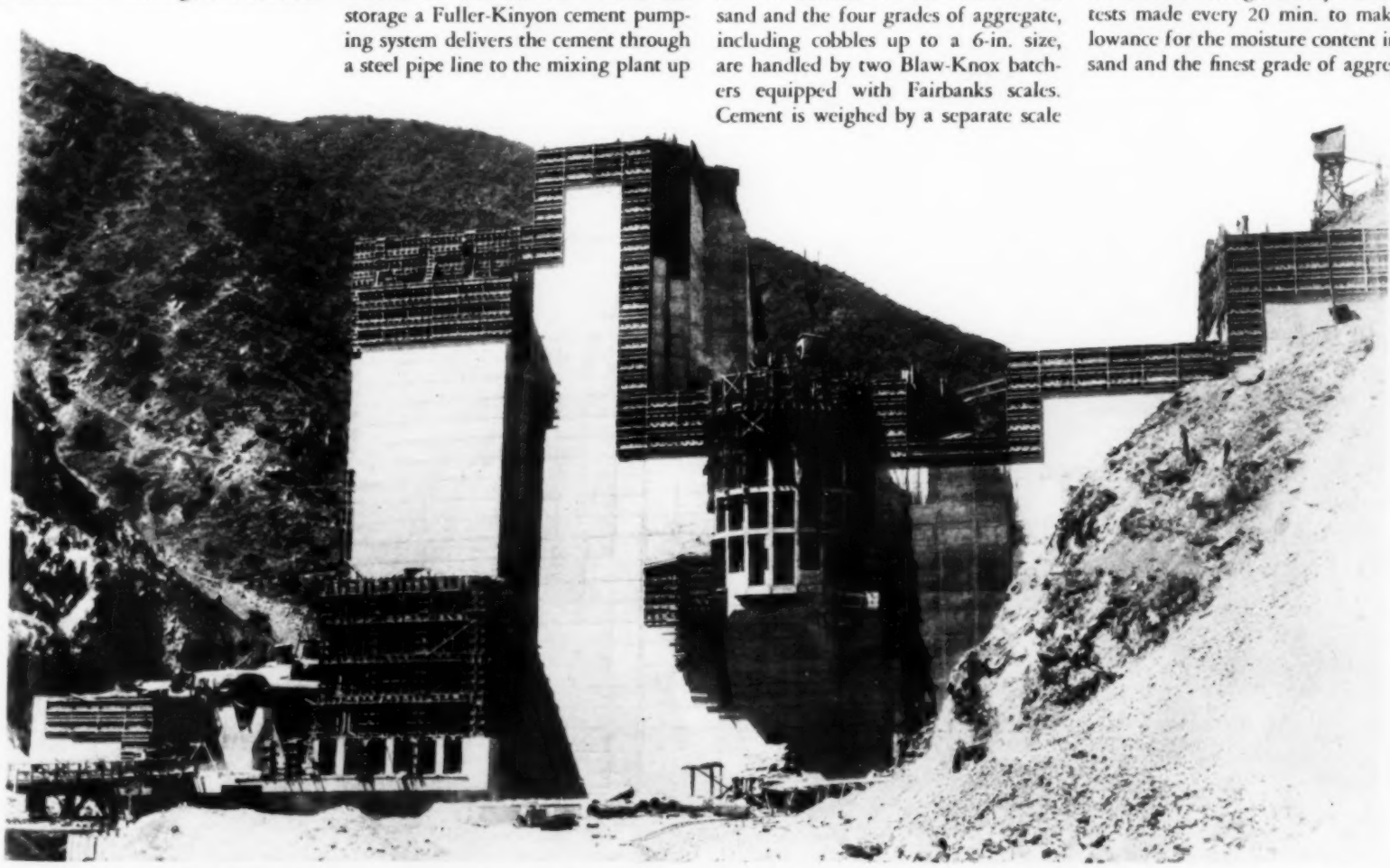
IMPROVED, self-closing bucket does not require any attention after it is tripped. Gates are closed by heavy counterweighted handles.

lb. is maintained on the traction rope which is driven by a 150-hp. motor located at the discharge terminal operating through a special grip sheave.

At the loading end of the tramway a crew of four attends to filling the bunkers and loading the buckets and one man at the discharge end controls the filling of the bins at the mixing plant.

Bulk Cement Pumped—Cement is trucked to the site in bulk with the truck and trailer units carrying a total load of 21 tons. These loads are stored in a 4,000-bbl. steel cement silo at river level below the dam site. From this storage a Fuller-Kinyon cement pumping system delivers the cement through a steel pipe line to the mixing plant up a record-breaking vertical lift of 302 ft. and a 730-ft. length of pipe. A Fuller-Kinyon compressor at the silo provides 320 cu.ft. of air per minute for the pumping lift.

The aggregate and cement are stored at the mixing plant which is located on the west abutment of the dam site. The sand and the four grades of aggregate, including cobbles up to a 6-in. size, are handled by two Blaw-Knox batchers equipped with Fairbanks scales. Cement is weighed by a separate scale and discharged into a separate compartment of the batcher to keep it from contact with the moisture in the sand until discharged into the mixer. Gates for batching are air-operated and the accumulated batches are discharged into the two Davis 4-yd. mixers. Water is measured through Crosby meters and tests made every 20 min. to make allowance for the moisture content in the sand and the finest grade of aggregate.

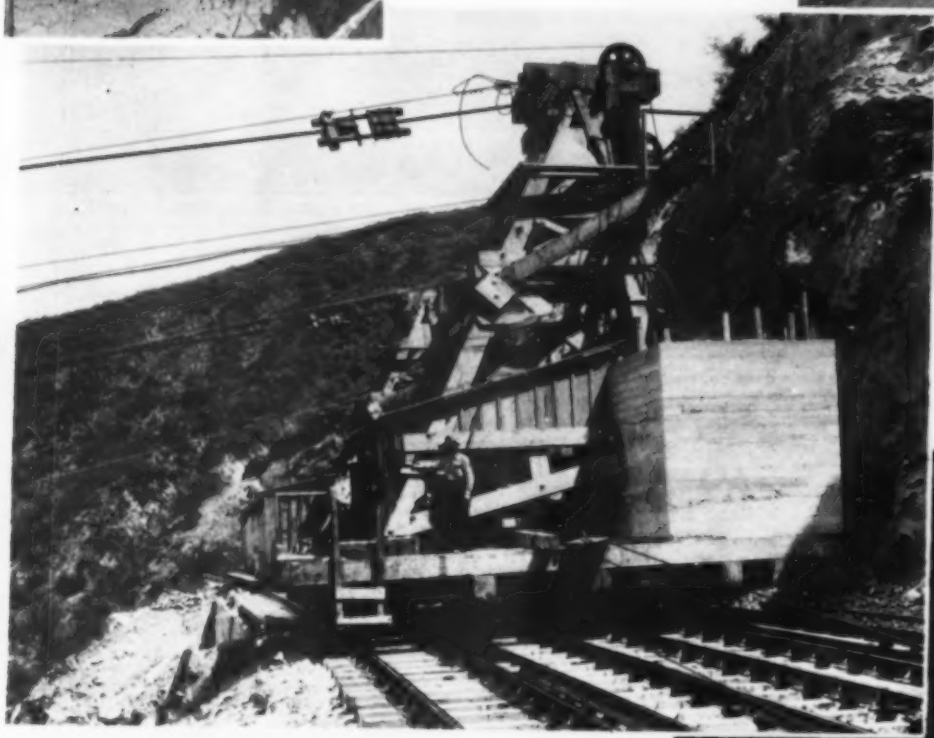


FORMS for concreting are metal-lined timber panels. Dam, when completed, will be 240 ft. high above stream bed and will require placing of 440,000 cu.yd. of concrete delivered by cableway buckets.

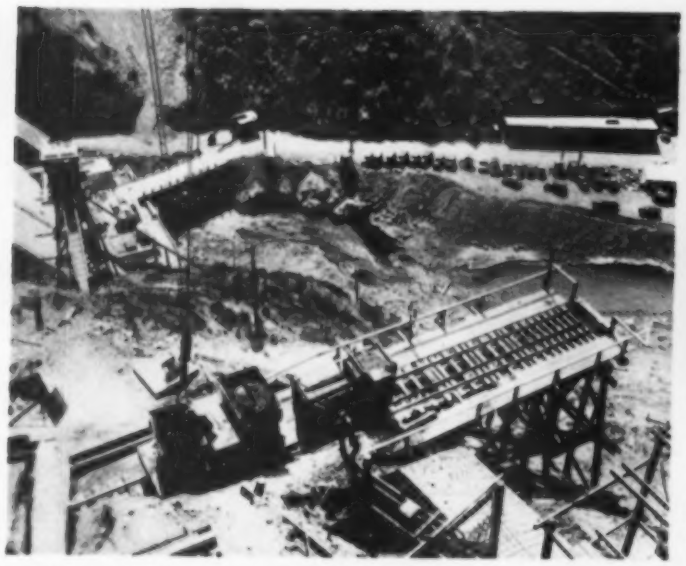
Cableways—Concrete is handled by two 10-ton radial cableways spanning the canyon from the mixing plant to traveling tail towers on the opposite canyon wall. These cableways were designed to cover the entire dam area with the exception of the extreme downstream toe, where a steel stiff-leg derrick was used during early operations to rehandle the concrete. A 100-ft. timber head tower, for both cableways, is located directly behind the mixing plant. The two counterweighted tail towers move along a 340-ft. length of radial track at a speed of 150

DRY CONCRETE *(left)* being packed against face of forms with pneumatically operated vibrating spade.

TRANSFER POINT *(above)*, showing aerial tramway terminal and tail-tower of cableway serving dam site

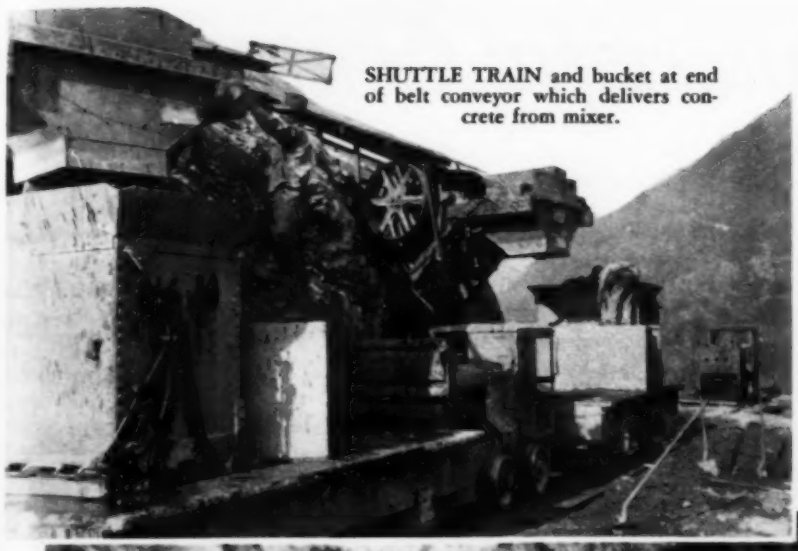


TRAVELING TAIL-TOWER *(left)* of cableway, showing counterweight and radial track. Tower moves by remote control from hoist house of head tower.



BUCKET-CHANGING operations. Cableway hook is being transferred from empty bucket to loaded one delivered on flat car by industrial locomotive.

UNUSUAL LOAD *(right)* is handled by cableway when Caterpillar tractor, equipped with winch for pulling rocks sleds, is raised to top of dam.



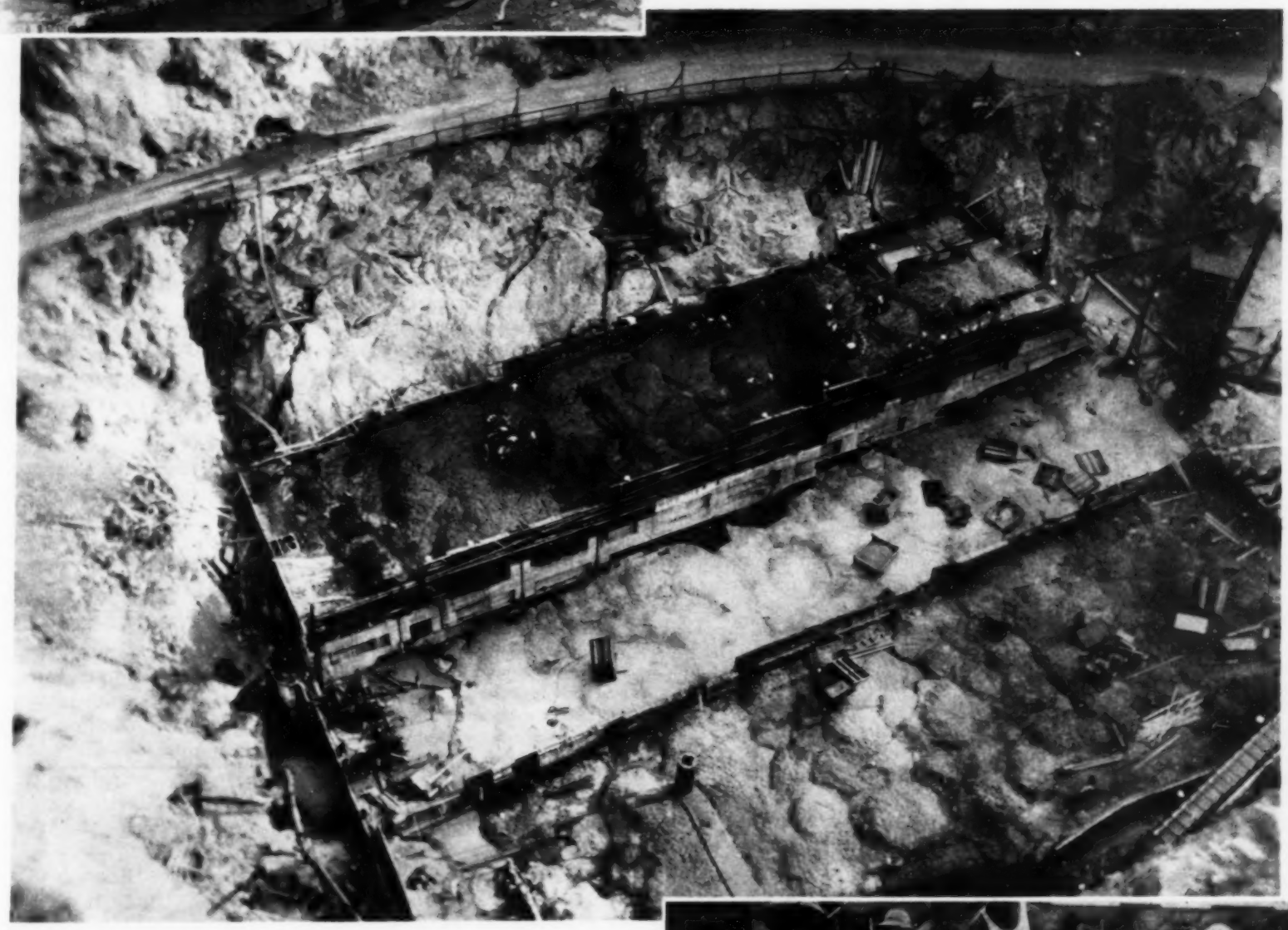
SHUTTLE TRAIN and bucket at end of belt conveyor which delivers concrete from mixer.

cableway to make the bucket transfer.

This changing of buckets provided a critical problem in the speed of concreting operations. At the beginning some delay was experienced, but as the crews acquired training and experience, the operation has been perfected to eliminate practically all delay. The operation is complicated by the fact that it requires the coordinated effort of four men, the hookman, motorman, signal man and the hoist man, who works "blind". The empty bucket arriving by cableway is lowered to the platform car and a slacking of the line permits the unhooking of this bucket. The slight rebound in the cableway resulting from stopping this lowering of the hook permits the train to move a few feet, putting the loaded bucket under the hook. Then, a second short drop of the hook is sufficient to permit the hook man to engage the full bucket and the transfer has been completed.

Directed by the signal man, these 4-yd. loads of concrete are moved to the place of pour and in usual operations one cableway is used to handle the concrete for one block.

Concrete Placing—Concrete is placed in 5-ft. lifts with a specification that the surface is to be maintained on a 1:10 slope up from the upstream face. Timber panel forms, metal lined, are



CONCRETING OPERATIONS as observed from a cableway bucket. View shows character of surface of each lift and individual batches of concrete.

ft. per minute. The tail towers are operated by remote control from the main hoists. The cableway span is about 1,000 ft. and the track cables are 2½-in. Langlay, made by John A. Roebling's Sons Co.

The operations of the cableways are controlled by signal men located in a lookout station on the west abutment. Each signal man directs the operation of the hoist man for his particular cableway by means of bell signals and telephone.

Concrete Handling—The key to concreting operations is the transfer of the loaded and empty buckets on the cableway. Each 4-yd. batch of concrete is moved by a 50-ft. belt conveyor to a shuttle train which handles the buckets. The train moves the empty buckets received from the cableway under the discharge end of the conveyor belt, placing each 4-yd. batch in a 4-yd. bottom-dump bucket. The train then moves out a short distance under the

HANDLING *(right)* 4-yd. batch of dry concrete with vibrators. Note that workers do not sink into mix.

built in a shop near the mixing plant, transported by cableway and used with the usual system of braces and tie wires.

The concrete buckets are maneuvered to within a few feet of the concrete surface and tripped. The bucket design first used required that two men from the concrete crew ride the bucket on its upswing, close the gate and then drop off again as the bucket returned close to the concrete surface on the rebound. A subsequent improvement in the bucket design, which provides heavy counterweighted handles and other minor changes, makes the bucket door self-closing and represents a distinct improvement over the first design.

The concrete batches are handled by a crew of eight men, including a foreman. Little shoveling is done and practically all the manipulation and burying of the cobbles is accomplished by means of three Vibro Spades and a platform type of vibrator operated by two men. The concrete is a very dry mix and has a slump of about 1 in.—practically a "no-slump" concrete. The use of the vibrators makes it possible, according to those in charge of concreting, thoroughly to compact drier concrete than could be handled in any other way.

Low-Heat Cement—One of the special innovations in the Pine Canyon Dam concrete is the use of a low-heat cement. This cement is furnished by four local cement mills and has met other requirements in addition to reducing the heat-of-hydration to a figure of 65 calories per gram at the end of a 28-day period. Records obtained on the rise in heat in the concrete show an increase of 36 deg. (72-deg. pouring temperature) to a maximum of 108 deg. This 108-deg. maximum temperature in the mass concrete corresponds to a figure of about 130 deg. which would have resulted from the use of ordinary cement. The difference of about 20 deg. in heat rise effects important savings in the design stresses as the result of the decreased expansion and subsequent contraction of the concrete.

Organization—S. B. Morris, chief engineer and general manager of the Pasadena Water Department, is directing the Pine Canyon dam project. C. E. Pearce is designing engineer and Ross White is construction engineer. Verne L. Peugh is resident engineer at Pine Canyon dam.

The low bid of eight submitted was by Bent Brothers, Inc., Winston Bros. Company, and Wm. C. Crowell at a figure of $2,407,311. This joint contracting organization was awarded the contract in April, 1932, and specifications require completion by the end of 1933. The manager of the contracting organization on the project is Stanley Bent. Lee Brider is general superintendent and Ed. Whipple is assistant superintendent.

Helps to Successful Contracting

Tenth of a series of articles on applying business principles to construction and making profits by avoiding costly mistakes

X—Relations With Engineers

By HARRY O. LOCHER

Contractor, New York

ON a concrete dam cableways were used to transport the plum rock to the structure. One day a skip came back to the loading point containing several pieces of granite evidently rejected by the inspector on the dam. The contractor happened along and noticed them. Seeing no reason for their rejection, he sent a foreman to the dam to inquire what the trouble was. The foreman returned and reported that the inspector had rejected the stone on account of a few grease spots caused by some oil dropping from the sheaves in the cableway carriage.

Now, on the face of it, this incident seems ridiculous and it was. But it was not the grease on the stone that was responsible for the inspector's action. That was an outgrowth of the general attitude of friction and belligerency that had unfortunately grown up on this particular job. It was a trying job for both engineers and contractors. The engineers were over-zealous in the interpretation and discharge of their duties and the contractor's organization was always ready for a battle. Chips seemed to be on everybody's shoulder most of the time. This situation, in addition to the difficulties it imposed during the carrying on of the work, resulted in a lawsuit that lasted for years, and, though won, ended as do most suits, disappointingly to the contractors and without full reimbursement for the loss they had suffered.

It is, perhaps, no departure from actual facts to say that no contractor has ever been fully satisfied with the result of any lawsuit he may have won, and justifiably so. Litigation rarely produces adequate compensation. Then, there are the countless suits that have been lost, making the situation worse.

"Records go a long way toward eliminating disputes and friction. Even the fairest men sometimes forget verbal agreements and instructions."

When friendliness and cooperation do not exist between the entire contractor's organization and the engineers and inspectors, it is in most cases just plain disaster. Often a trivial circumstance or incident, which would be smashed at its very birth by tactful, diplomatic, practical construction men, is allowed to smolder until it flames into a state of open hostility and belligerency between the contractor's men and the engineers. Such a deplorable and costly situation gets right back, in most cases, to leadership. Broad-gaged men with horse sense, tact and diplomacy can avoid such situations altogether, or can kill 'em off before they grow to injurious size, even if it means a shuffling and a shake-up all around and changes in the personnel. When irritation and trouble arise between the contractor's organization and the engineers—and the trivial nature of the incidents that sometimes start these strained relations is often ridiculous—courage and bigness and tact are required to nip them in the bud. Timid, hesitant men, with petty thinking, prejudices and jealousy, and plain lack of courage, cannot be expected to handle such situations. They should not be allowed to remain in positions of authority when it becomes known that they are of this type.

Many a difficult, trying, low priced-job has been carried through to satisfactory and successful completion, under most trying circumstances and conditions, by sympathetic, whole-hearted cooperation between the engineers and the contractor's organization. In such cases real men were in charge and in authority on both sides, and their bigness and fair-mindedness were infused into their organization. Tact and diplomacy are a major part of bigness. Let no man with pretty ideas and beliefs, who is of a jealous and envious nature, think he is big and broad. He may try to act it, but if it really isn't in him, men see through him as through a sheet of glass.

Confidence Breeds Cooperation—The first requisite of cooperation on contract work is confidence. On a hydraulic fill dam, great difficulty was experienced in getting a sufficient amount of the right sort of core material free from sand and gravel and placing it properly in the dam. The engineer in charge called at the contractor's office late in the afternoon and said that the night inspector was sick and would not be out. "I am going to depend upon you", he told the contractor, "not to let any sand run out into that puddle." None did. This contractor, and his men in charge had the complete confidence of this engineer and they valued it most highly. Later on, when the supply of core material ran low and the unlooked for additional expense became burdensome, this appreciative, broad-gaged engineer designed and recommended certain changes and used his influence to get them approved. This helped to eliminate many of the contractor's difficulties and saved him a considerable amount of money, all due to mutual confidence and whole hearted cooperation.

On a bank protection job the plans, at certain locations, showed grouted riprap extending down to a point where it could do no possible good. The only way to place these small, scattered amounts of material was to sheet around the location and pump it out. On one section the engineer, a practical man, who worked conscientiously with the contractor, saw the uselessness of this grouted paving and its cost to the contractor and did not require it to be put in. Several sections away a similar situation existed, but there the contractors, superintendent and the engineers had "locked horns." When the superintendent complained about the uselessness, difficulty and cost of placing this riprap, the engineer came back with, "The plans call for putting it in, so in she goes. How? That's up to you. Lose money doing it? That's your fault; you folks did the bidding." And that ended it.

"No contractor has ever been fully satisfied with the result of any lawsuit he may have won. Litigation rarely produces adequate compensation."

A Row with a Foreman—I must tell here of a rather unusual incident, one that shows the bigness of an engineer to an extraordinary degree. An energetic, impulsive man had been made concrete-placing foreman on a retaining wall job. The engineer was scrupulously careful about cleaning off the surface at the bottom of the forms before any concrete was placed, and justifiably so, as the wall was built alongside several plants and any leakage at the bottom would no doubt have caused a great deal of trouble. The engineer had given instruction that no concrete be placed until he had inspected the forms.

One morning an unusually large form was made ready for concrete, and as the pour had to be made in one run

the superintendent was anxious to get started. But our engineer was not around to give the word. Being on most amicable terms with him, the superintendent thought if he inspected the forms and found them all right there would be nothing wrong about going ahead. He did this. When two cars of concrete were placed—the superintendent having gone to another part of the job—the engineer showed up on the trestle with fire in his eye and demanded of the foreman, in vitriolic language, who instructed him to begin placing concrete.

"The super," replied the foreman, going the engineer one better with some red hot cussing.

"Not another hatful until I give the word," the engineer spat out.

"Beat it. I take orders from the 'super' and nobody else," the excited and over-zealous foreman replied.

About this time another car of concrete rolled in and the foreman viciously kicked out the latch and prepared to dump it. The engineer took hold of the car and tried to stop him. The car oscillated back and forth as they wrestled with it, but finally the husky foreman got the better of the contest and down went another batch of concrete into the forms. At this point the engineer completely lost his head and swung his fist to the foreman's face. The fight was on. It was fast and furious while it lasted, but in a little while it was over. The engineer came off second best, bloody and badly mussed up. He immediately sought the superintendent and told him the story, confessing that he had lost his head, and that he felt that the responsibility for what he called a disgraceful thing was his. He admitted that the foreman was properly obeying instructions from the only head he recognized, and that it was not his fault for not knowing that the engineer had the right to issue orders too. He concluded by saying, "He's a cracking good man and I don't want you to fire him."

Due to the friendly relationship between the engineer and the superintendent this incident left no rancor of any kind. But had this most friendly relationship been lacking, the incident might have proved costly to the contractor.

We told, in a preceding article, of the amazing situation in which an assistant superintendent and the engineer would not speak to each other unless it was absolutely unavoidable. In a situation like this there can be no other possible conclusion but that the contractor is the loser in many ways. It is quite within the realm of possibility that he may be losing in ways he does not dream of. Often, and without justification, the engineers are the dumping ground for the contractor's troubles.

A nationally known and respected contractor, whom one great engineer said was a joy to work with, tells this story about engineers: He was offered a cut on a new railroad job at a certain price. He considered the price too low and did not take the job. But another contractor did, at the price offered. The traveling bookkeeper for the general contractors, who was also a friend of the contractor who had turned down this job, kept him posted as to how things were getting along, as he visited the work every few weeks.

Giving Engineers Hell—At first he reported things were going along fine; they had moved in and gotten nicely started and they were all feeling good. The next time he came around he said things weren't quite so rosy down the line; there had been lots of rain, men were scarce and so forth; but things would change for the better soon, they thought. The next report was still more gloomy. They needed more teams and men; it kept raining; they weren't moving nearly as much as they hoped to and costs were running clear out of sight. The final report—last resort for disappointed contractors—was, "They're giving the engineers hell."

Now, it's pretty hard to help a bad situation by giving the engineers hell. In most cases the engineer can ladle out this stuff himself, and do it where it hurts and costs. He doesn't want to do it, but can be goaded to it by lack of reason, gross imposition, unfairness and lack of sincere cooperation from the contractor's organization.

"Don't think you are economizing by employing a second-rate superintendent at a second-rate salary. He is almost always sure to be the most expensive man on the payroll."

It's a poor man indeed, whether he be on the contractor's side or the engineer's, who will not respond to fair dealing, cooperation, understanding, full appreciation of duties and interests, and a real earnest, sincere desire to be as of much service as possible. A non-cooperating, tactless, antagonizing man in a contractor's organization is a liability and a blot. A contractor could render himself no greater service than to deliberately take the time, frequently to call his men together and infuse in them the vital importance of cooperation and team-work, between themselves and the engineers or owners and among themselves. Or, he should have a superintendent, such as we described a few months back, who could do this organization-building work effectively.

Many a contractor who thinks he has a splendidly cooperating, loyal, smooth-running organization, would be amazed if he knew what a seething cauldron of discontent his outfit really was. This is due to his own ignorance of, or lack of interest in, this important feature of his business or to his superintendent's lack of ability, courage or complete honesty, because most any kind of a superintendent at all knows when he has a smooth-running organization.

Surface Indications Deceiving—Do not trust too much to the surface; get down under it and see if all is as it should be. A smooth-running, cooperating organization, with splendid team-work among its own members, and the engineers, and under the leadership of a real superintendent, can be depended upon to get maximum results under the most difficult conditions and trying circumstances. In the exercise of tact, diplomacy and wholehearted cooperation there is all to gain and little or no chance to lose. Plain thoughtlessness in some cases and plain littleness in others accounts for much of the combative spirit in relations between contractors and engineers.

"Many a contractor who thinks he has a splendidly cooperating loyal, smooth-running organization, would be amazed if he knew what a seething cauldron of discontent his outfit really was."

I must come back to it again and repeat that this getting along is mostly up to the superintendent. In many, many cases he's the man who builds up or tears down your bank account, away out there in the field, depending on whether he handles or mishandles himself and your men on the job. Select him carefully. Then back him up and depend upon him. And, if possible, compensate him in major part by some sort of bonus method where he can be paid according to the results he produces. A bang-up superintendent has faith and confidence in himself. If you give him charge of a job where there is possibility of profit he is willing enough to take his compensation from the results he produces. On a low-price, non-profit job this type superintendent will work just as hard or harder—most always he has to. Don't think you are economizing by employing a second-rate superintendent at a second-rate salary. He is always sure to be the most expensive man on the payroll.

A cooperating organization, imbued with friendliness, diplomacy and tact, serves another great purpose. It smooths the way in getting along with owners, principals, business houses with whom you deal and property owners adjacent to and in the vicinity of your work.

A Testy Mill Man—A head-race on a power-house job abutted the foundation walls of some buildings. Both the power project and the mills belonged to the same man. But the mills were operated by an old war-horse with whom the superintendent on the power-house job could not get on a friendly basis. Finally, the old fire-eater became such a nuisance that something had to be done. The superintendent had established the most friendly relations with the property owner. So he took his case to him, telling him that the mill owner was putting every possible obstacle in his way and was very measurably holding up his work.

"Plain thoughtlessness in some cases and plain littleness in others accounts for much of the combative spirit in relations between contractors and engineers."

Just what took place was not known, but the man's attitude changed over night and there was no more trouble. The superintendent, being interested in human nature, kept working on this mill man and finally built up a warm friendship with him which later helped in many ways. This was much better than to say at the start, "To hell with him," and battle with him for every inch of ground through the entire length of the job.

Records Reduce Friction—Records go a long ways toward eliminating disputes and friction. Even the fairest of men sometimes forget verbal agreements and instructions and force contractors to do certain things without compensation when the agreement had been otherwise. But when you can produce an order, agreement or letter and say, "Here it is," that settles it one way or another, and this is true on either side of the house.

Avoid Lawsuits—Before sallying off to the Court House to sue some owner or principal or to present some claim for extra work or certain contingencies, (immediately incurring his ill-will and putting him on the defensive against you) try friendly give-and-take arbitration—it most always works. Of course, some litigation is unavoidable, but it should be a contractor's last resource. Before resorting to lawsuits, weigh the situation carefully and from every possible angle; weigh the probable cost against the probable net result; get the sober judgment of competent, unprejudiced advisers. The conclusion is generally reached, after such deliberate action, that on the job is a better place to try and earn profits than in the Court House. And getting along with and cooperating with the engineers go a long way toward earning these job profits. If you do your part most of them are with you there, but in the Court House they are always "agin" you.

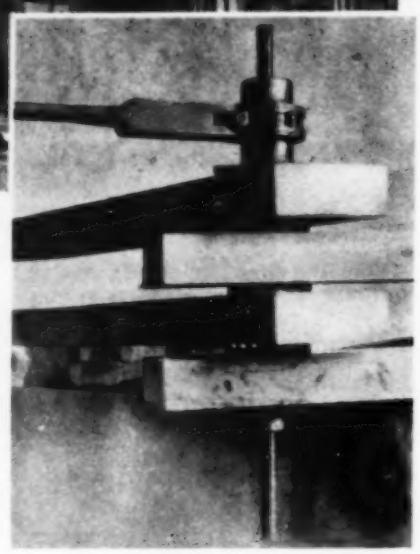
NEXT MONTH—"Relations with Employees" will be the subject of the next installment of Mr. Locher's series of articles.

TIMBER ROOF TRUSSES fabricated with modern connectors at joints span three 70-ft. bays of railway car construction shops at Dessauer, Germany. Three monorails of 1½-ton capacity each have since been suspended from lower chords of roof trusses.

IMPROVED CONNECTORS

Open Wider Field for Timber Structures

NEW connectors for framed timber structures, designed to develop increased strength at the joints with a saving in lumber and hardware, have been in use in several European countries since the latter years of the World War, when severe economic conditions compelled renewed attention to wood construction. Continued invention and improvement of efficient connectors have resulted in the development of more than 60 types, a number of which have been tested at the Forest Products Laboratory, Madison, Wis., to determine their load capacities when used with common American woods. The results of the tests have been published in a book, "Modern Connectors for Timber Construction," by the National Committee on Wood Utilization and the Forest Products Laboratory. Copies are available at 15c. each from the Superintendent of Documents, Washington, D. C.



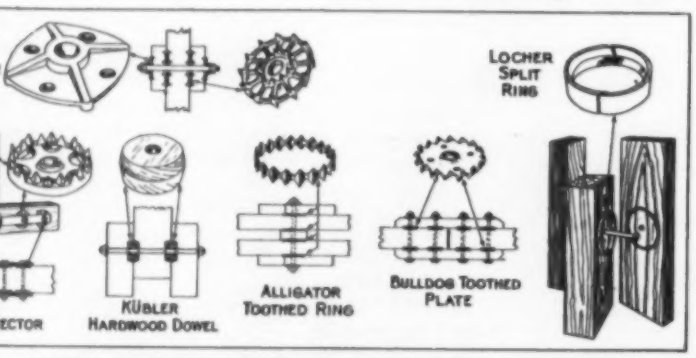
ALLIGATOR TOOTHED RING CONNECTORS are pressed into wood members with ratchet wrench.

Types of connectors selected for the tests were those which had proved commercially important in Europe, and which are well adapted to structural purposes in the United States. As shown by the accompanying sketch, these types include rings, plates, and disks, some toothed and some plain, which are inserted between two members to be joined together and embedded partly in each. A bolt through the center binds the joint together, but the connector, and not the bolt, acts as the load-transmitting agency. Test results confirmed what had long been demonstrated by experience abroad—that the modern connectors provide several-fold greater strength at the joints and increased rigidity in the structure.

Increased strength is gained by development of a greater percentage of the gross cross-sectional area at the joint than is possible with typical bolted connections. Another advantage of the modern connectors is that they largely eliminate eccentric joint construction with its resultant bending stresses found in the bolted connection. The modern connectors also lend themselves readily to utilization of boards and planks in built-up members to replace heavy solid timbers. Finally, in joints which would require a number of bolts to transmit a given load, the weight of modern connectors required to transmit the same load is much less.

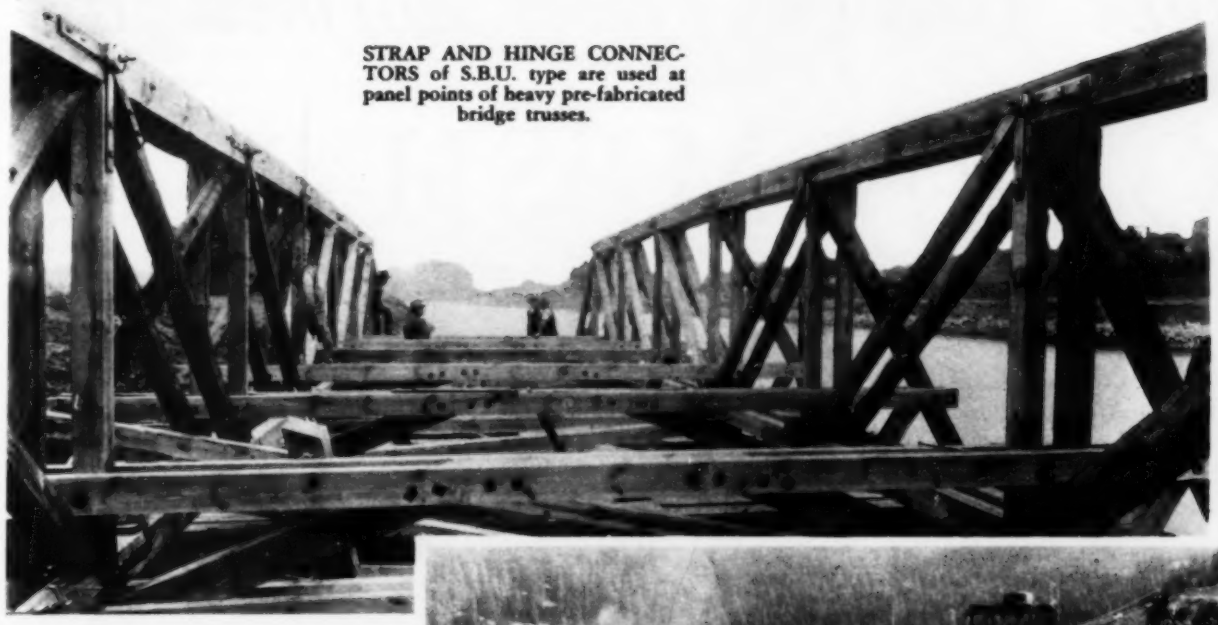
These factors permit use of lumber in smaller sizes and of lower mechanical properties than formerly was necessary. Smaller members contribute to a slenderer appearance in the structural frame. The new connectors have encouraged employment of trussed arches in European designs.

Prefabrication of Timbers — All shaping, cutting and boring of timber structures can be performed in advance in the shop, saving time and labor in



TYPICAL MODERN CONNECTORS increase capacity of framed timber joints by providing bearing resistance on surface of members, thus developing larger proportion of gross cross-sectional strength than with bolted connections.

ROOF-TRUSSES *(below)* framed with split-ring connectors are designed for heavy snow loads on farm warehouse in Alpine region.



STRAP AND HINGE CONNECTORS of S.B.U. type are used at panel points of heavy pre-fabricated bridge trusses.

the field. The shops are equipped for this work with power-driven saws, boring machines and other power tools.

Structural units may be shipped either assembled or knocked down. If not assembled, the pieces are marked for erection, and the connectors may be inserted at the shop, leaving completion of the joints and placing of bolts for the field force.

Costs have been reduced through these more efficient fabrication methods and also through a saving in the amount of wood required for a structure. Prefabrication gives opportunity for skilled selection of grades, expert supervision, and elimination of waste material, with resultant saving in freight.

Application — Modern connectors have been used in the construction of hundreds of wood structures of every kind. Among them are numerous radio towers, one of which is 460 ft. high, bridges more than 1,000 ft. long, an auditorium with a seating capacity of 75,000 persons, piers, railroad stations, locomotive shops, warehouses, churches, and airplane and airship hangars.

SHOP FABRICATION AND ASSEMBLY of trusses *(below)* for Stuttgart railway station corresponds with steel shop practice.

TIMBER CONSTRUCTION TRESTLE 680 ft. long at Bleiloch Dam, Germany, has pre-fabricated 83-ft. trusses with S.B.U. connectors at joints.

Types of Connectors—As indicated by the accompanying photograph and drawing, the S.B.U. (Siemens-Bauunion) connector is a hinged type especially useful in joining solid timbers. The wood is stressed parallel with the grain. A heavy steel ring at the center of the joint grips steel straps attached to the wood members by circular claw plates of aged cast iron, bolted to the straps and pressed into the wood on both faces.

A type used to splice timbers at a rigid joint is the Bulldog connector which consists of a steel plate with teeth spaced evenly along the edges at an angle of 100 deg. with the plate. The joint is formed by placing the connector between two wood members, forcing them together, and then holding them in place with a bolt through the center of the connector.

Another dowel type is the G.S. (Gösta Smitt) spike connector consisting of a cast spike plate, outside washers, and a through bolt. In assembling a joint, a bolt hole is drilled, the spike plates are inserted, and then the bolt, well oiled, is drawn up tight, forcing the spikes into the wood members. High-strength bolts may be used for this purpose and then replaced with ordinary lower-tension bolts.

Both closed and split rings occur in a group of ring dowels. The Locher is an example of the split ring. These rings fit into circular grooves cut in the faces of the timbers by a motor-driven boring machine.

Most important of the toothed rings is the Alligator connector, which consists of a circular band of low-carbon steel about 1/16 in. thick, cold-rolled, stamped and bent to shape. This ring dowel is embedded by tightening the nut on the bolt, forcing the connector into the wood.

Of the disk and coned dowels, the Kübler is the best known type. These dowels were originally of cast iron but now are made largely of oak. They are solid except for the bolt holes and fit into bored holes, instead of grooves, in the wood members.

Light-Weight Bridge Floor Formed by

OPEN-MESH FLOORING

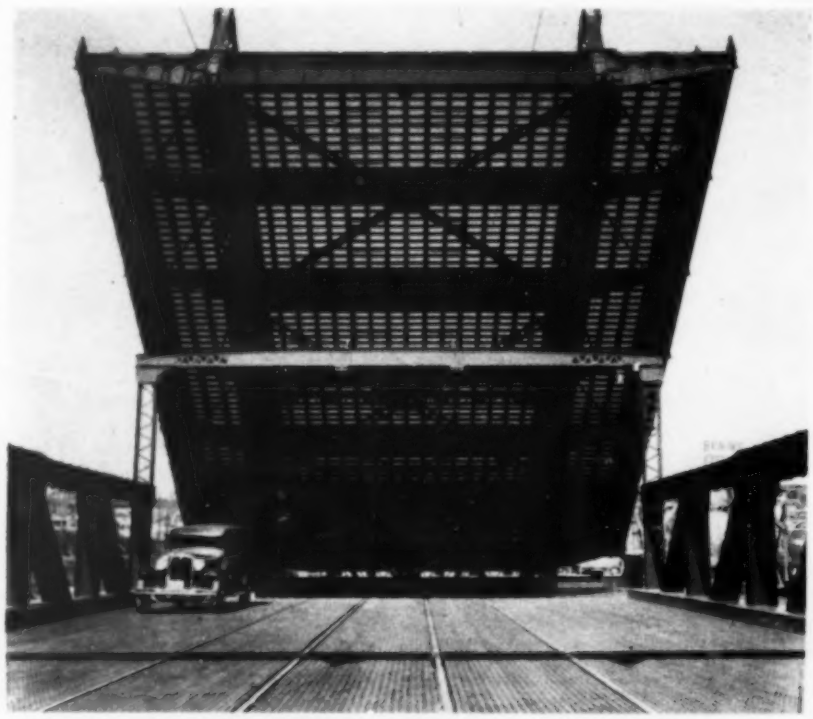
By J. A. DUNFORD
Bridge Engineer,
City Engineer's Office,
Seattle, Wash.

USING an open mesh steel floor for the first time on highway bridges, the City of Seattle, Wash., has completed extensive improvements to the University bascule bridge, one of three double-leaf trunnion bascule spans built in 1916-1919 to cross the Lake Washington ship canal. The bridge is an important link between the main business center and the University of Washington.

The original cost of the structure was $830,000, which included the bascule span of permanent construction and approaches of temporary or untreated wood construction, 1,468 ft. in overall length. The roadway width throughout was 40 ft. for double-track street car service and a vehicle traffic which increased steadily from 8,000 vehicles per day in 1919 to 38,000 in 1931, when the bridge was closed for the improvements.

Permanent approaches with roadway width 58 ft. between curbs and widening the bascule span to provide two extra traffic lanes outside the bascule trusses constituted the major part of the new work. The plans also provided for a temporary detour structure with a single leaf bascule.

In February, 1932, contracts were awarded for the permanent approaches, which included building the temporary detour structure, to the General Construction Co. of Seattle, and for widening the bascule span, to the Puget Sound Bridge & Dredging Co. of Seattle. The table on page 28 summarizes the construction costs.

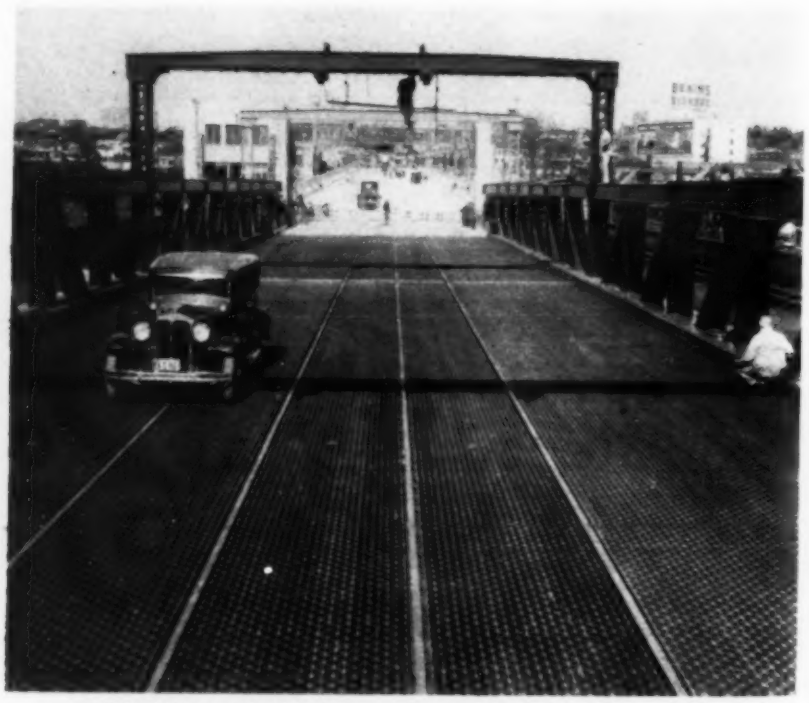


OPEN-MESH STEEL DECKING on floor of bascule span weighs only 15 lb. per sq.ft.; supplementary channels increase weight to total of 22 lb. per square foot. Note that horizontal portion of span, as seen by car drivers, appears solid, while open effect is produced by raised leaf of bascule.

Design Factors — To increase the width of the bascule roadway approximately 18 ft. and not seriously overload the span or greatly increase the counterweight space, it was necessary to design a light type of paving, or roadway surface, to replace the wood block paving on the original 40-ft. roadway and to pave the proposed extra roadway surface. The then existing floor system, in which was included the steel floor beams and steel stringers, weighed approximately 156 tons for each river arm and, being a counterweighted structure with a 2 to 1 ratio in lever arms, required 312 tons to balance, or a total of 468 tons dead load for each bascule leaf, due to the floor system alone. On the basis of these weights the extra or proposed roadways would have added approximately 210 tons to each bascule leaf. These extra loads, when reduced to unit trunnion pressures and to added dead load stresses in the bascule trusses, were found to exceed greatly the allowable for bascule spans.

To reduce the weights of the widen-

REMOVAL of old flooring. Stiff-leg derrick, designed to travel on outer rails of street car tracks, handles materials to and from scow in channel below.



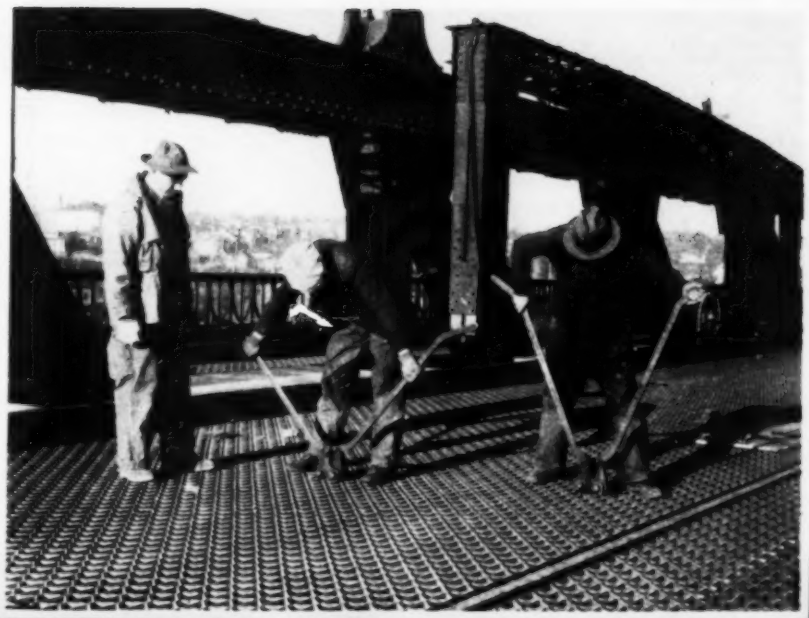
FINISHED ROADWAY of open-mesh steel decking, when viewed at flat angle, appears solid and develops desirable anti-skid properties.

ed bascule roadways it was decided to install open-mesh steel decking designed and manufactured by The Irving Iron Works, of Long Island City, N. Y. This decking is unusually light, weighing only 15 lb. per square foot of roadway surface. The advantages in weight gained through the use of the light Irving decking and considerable savings in weight through the use of arc-welded steel for the outer roadway supports were important factors in the final success of the widening scheme, as shown by the accompanying figures:

Materials added to each bascule roadway included: Structural steel supports and hand rail, 55 tons; steel floor materials, 44 tons; lumber in curbs and sidewalks, 14 tons; total 113 tons.

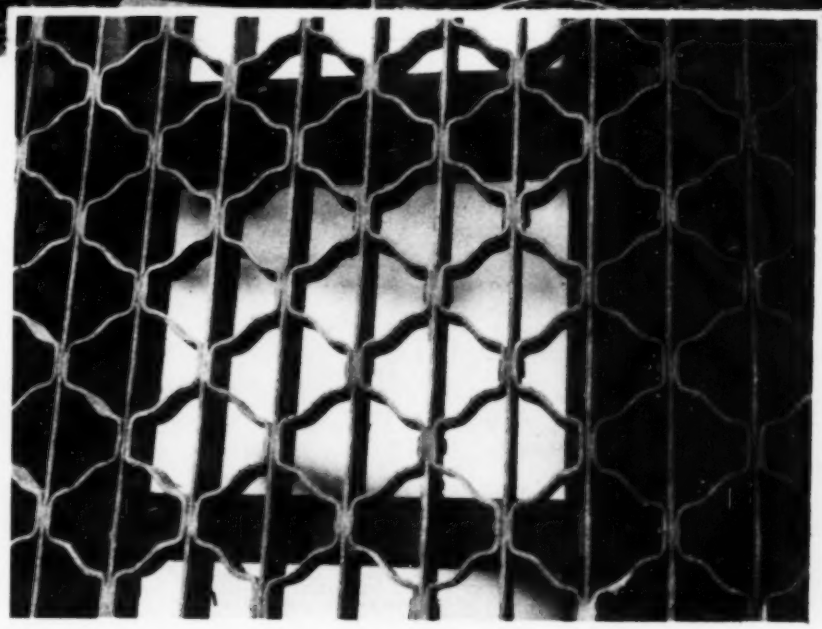
Materials removed from each bascule roadway included: Steel sidewalk brackets and hand rail, 9 tons; lumber, including paving blocks, 76 tons; total 85 tons.

The net weight added to each bascule roadway, therefore, was 28 tons. Additional counterweight amounted to 56 tons. The total added weight for each bascule leaf, consequently was 84 tons.



SPECIAL HAND TOOLS ***(left)*** **are used to squeeze ⅞-in. cold rivets used to splice 2x25-ft. prefabricated sections of flooring.**

INSTALLING OPEN-MESH FLOORING ***(above)*** **on existing steel framework of bascule span. End continuity between sections is obtained by splicing long and short straight bars with cold pressed rivets.**



DETAIL ***(left)*** **of decking, showing open mesh. Spacing between horizontal bars is 2 5/16 in. and between riveted connections in same bar, 5 in.**

Dead load stresses in the truss members have been increased 5 to 9 per cent, and theoretical live load stresses have been increased 12 per cent with the added roadway. In consideration of the very liberal loading provisions made in the original design, the added dead and live loads were found to be permissible. On account of limited space in the counterweight boxes for additional materials, a mixture of steel punchings and cement mortar was used to obtain the desired weight. The proportions for one cubic yard of this concrete mixture were as follows: 1.8 barrels cement, 677 lb.; 0.5 cu.yd. sand, 1,350 lb.; steel punchings, 4,300 lb.; total, 6,327 lb.

Arc-Welding—The use of arc welding for fabricating the supporting steel for the outer roadways and sidewalks, was a considerable factor in keeping down the weight on the bascule span. The outer roadways are supported on steel brackets securely tied to the floor beams through slots cut in the vertical truss members. The brackets were designed with tapered bottom flanges of plates and with stiffeners also of the

CONSTRUCTION COSTS

Permanent approaches, including a temporary structure with single-leaf girder bascule for detour purposes	$497,859
Widening the bascule span	73,088
Renewing electrical equipment, bascule span	12,375
Electrical equipment for the temporary or detour bridge	5,066
Yielding traffic barriers for permanent span	15,735
Yielding traffic barriers for temporary span	8,074
	$612,196

single plate type welded to the web. The top edges of the brackets are without flanges and are brought to a level with the 6-in. transverse channels to act as supports for the steel flooring. The outer roadway stringers are tied through slots in the bracket webs with plates welded to the upper and lower flanges of the stringers, giving these members added stiffness. To facilitate erection, enough rivets were used in stringer connections to make a safe assembly, and all tension connectors for brackets were made with rivets. At points on the span where brackets could not be connected to floor beams, 1x6-in. bars were passed across the floor system, tying the brackets together and also acting as a support for the steel grating.

The open-mesh floor has attracted the attention of engineers and others interested in highways, and many inquiries have come to the City Engineer of Seattle. Common among questions are the following:

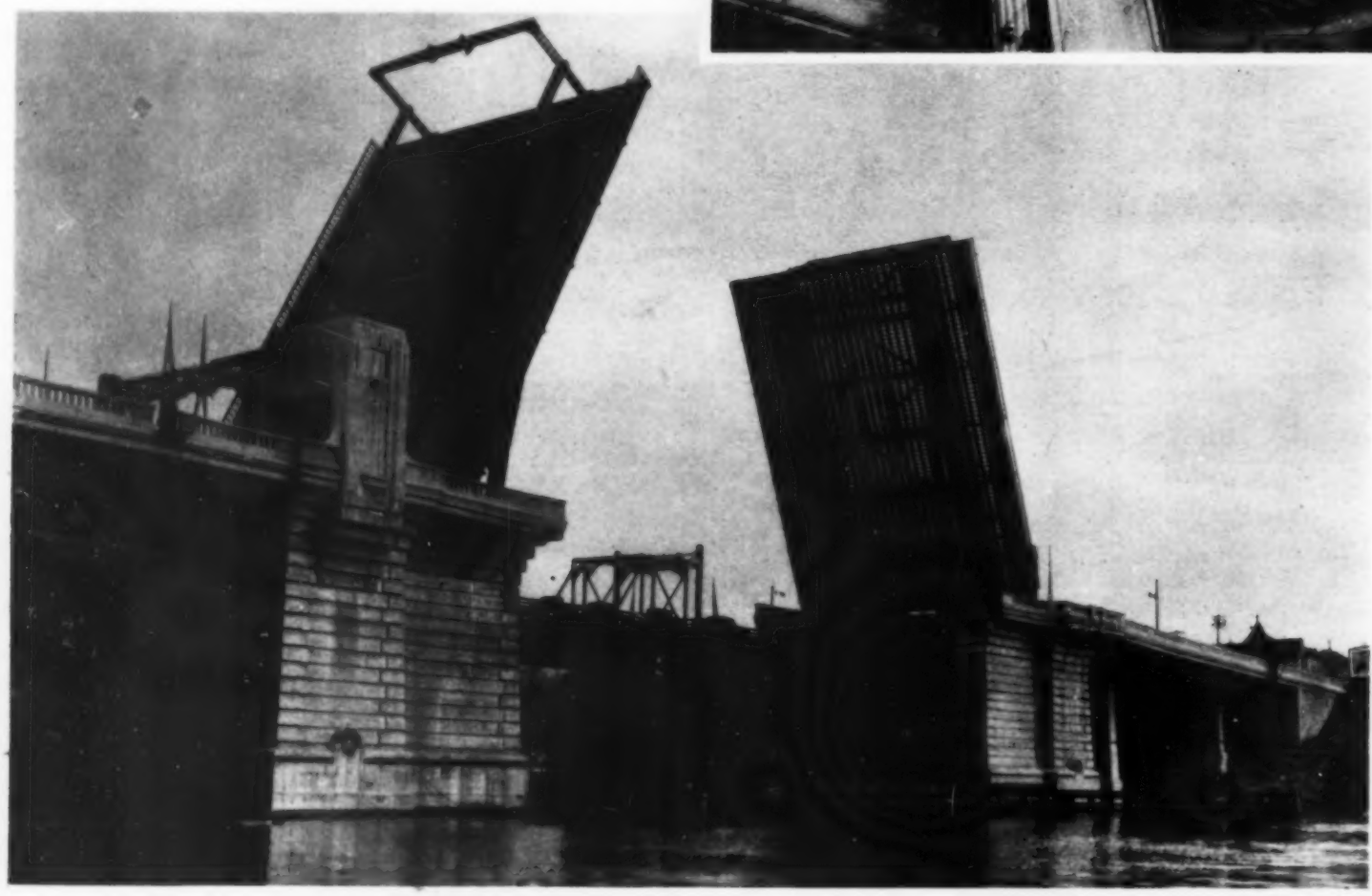
1. What is the attitude of the public regarding the open mesh flooring?
2. Is the paving injurious to rubber tires?
3. Is the paving safe to drive on when wet or when frosty?
4. Will the maintenance costs be relatively high?
5. Can a horse or other animals use this bridge?

By the traveling public the open floor has been well accepted. Strangers cross the span apparently unaware of the open spaces. Many comments have reached this department from users of the University Bridge and without exception they have been favorable. The following, taken from a letter recently received, is typical: "I rode over the University Bridge Saturday and was very agreeably impressed with the fact that you felt that your car was sure footed on such a roadway and the idea that the open grating would cause fear to the timid was entirely dispelled. I notice in driving you look at the grating at such an angle that the decking looks solid".

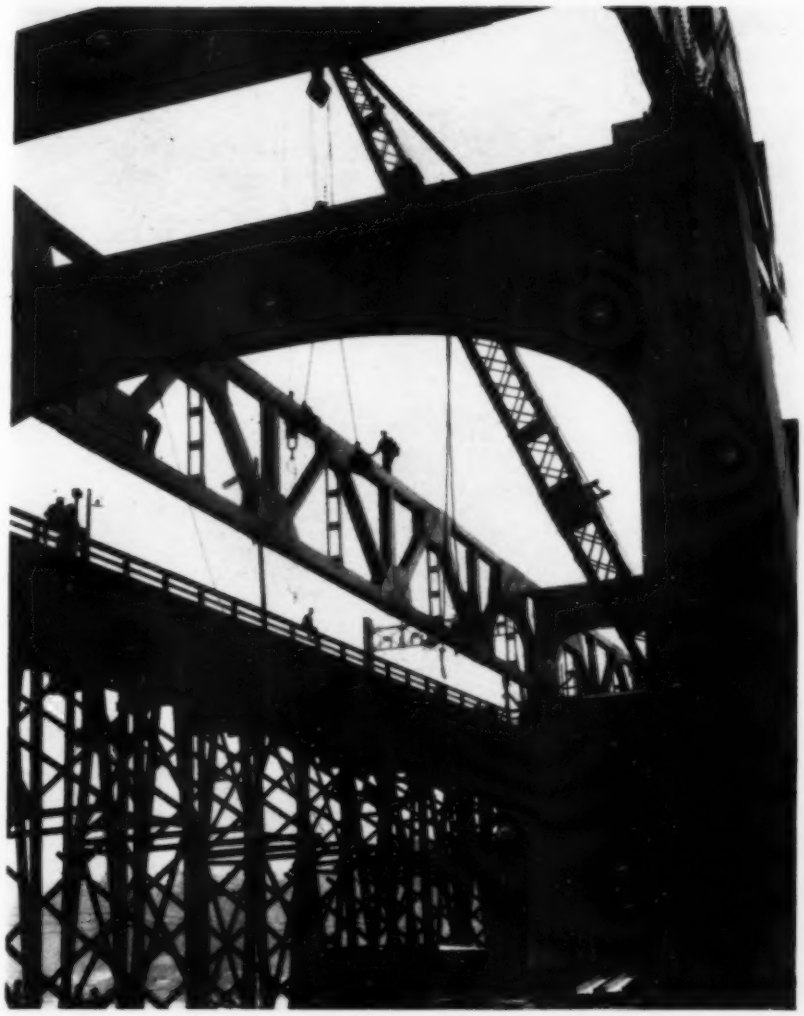
Tests made prior to opening the bridge to traffic indicated that the open mesh is no more injurious to rubber tires than are other types of paving.

The open mesh has proved to be not slippery when wet. Tests were made with a Friedli recorder, using a modern automobile, which showed the steel paving to be equal to new concrete in its ability to stop a car, and under frost and oil conditions it was found to be superior, as oil and frost quickly disappear from the steel under a small amount of traffic.

The cost of maintenance cannot, at this time, be estimated. Extra pieces of straight and reticuline bars were



REMODELED BRIDGE across Lake Washington ship canal has widened, lightweight bascule span and improved approach structure. Upper view shows temporary bridge, at left, carrying traffic prior to opening of remodeled structure.



STEEL GIRDERS for approach structure are delivered by scow and lifted to place by floating derrick.

furnished to provide for unusual accidents, and being an all-riveted grating, repairs will not be difficult to make.

The use of horses in this vicinity has diminished to a point where this class of traffic was not seriously considered when plans for improving the bridge were made. It was thought that the few draft and saddle horses could very well detour, if necessary, by way of other canal bridges.

Plywood For Concrete Forms — Douglas fir plywood was specified and used for concrete forms where appearance was an important consideration. A 3-ply product, ¼ in. thick, was used as form liner and a thicker plywood without backing was used where the forms were employed more than once. All plywood for concrete forms was treated with a form oil to prevent the concrete from adhering while they were being removed. The forms were oiled before each re-use. Consideration for using approximately 40,000 ft. of plywood for this work was: even surfaces and reduction of rub-down costs.

A special stiff-leg derrick, with an extra long boom, constructed to travel on the outer rails of the street car tracks, was used to handle material to and from scows and for placing materials in the work.

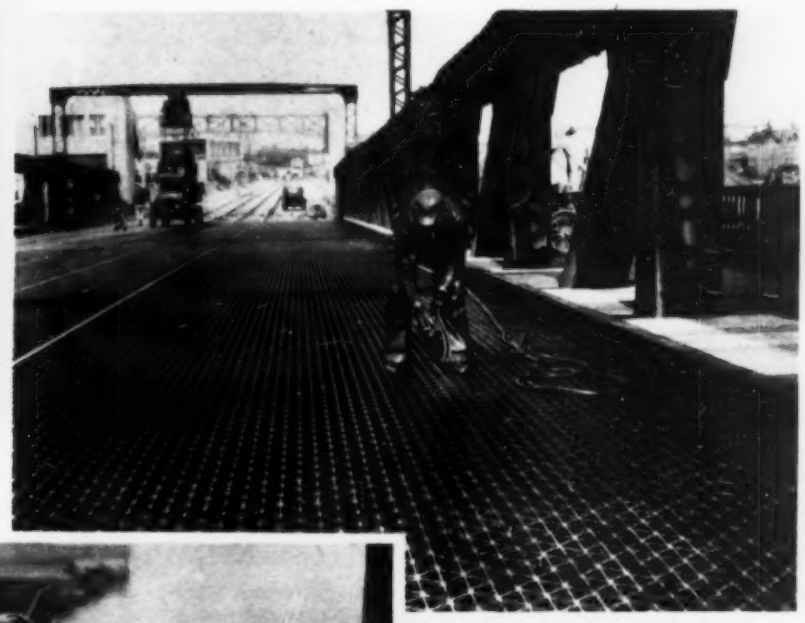
The street car rails, which were originally carried on plank sub-floor, are now supported on Bagac (Philippine mahogany) blocks. The flanges of the rails and stringers are drilled for ⅝-in. heat-treated bolts which pass through the blocks.

Steel For Approaches — Structural steel for the approaches—1,700 tons —was fabricated by the Wallace Bridge & Structural Steel Co., of Seattle, with shops located on the Duwamish Waterway. The trusses were made in sections up to 40 tons and shipped to the bridge site on scows, where erection was done by a floating derrick. This combination effected a considerable saving in field erection costs and resulted in superior workmanship.

Yielding Traffic Barriers — Special traffic barriers of the yielding steel net type were a part of the reconstruction program. The yielding nets are normally housed in special roadway portals and are operated into position across the roadway by electric motors, controlled by the bridge tender in the operator's house. There are four complete units, two for the main or original roadway and two for the outside roadways, the latter to protect the oncoming traffic only. The nets pay out against brake-drum action and are designed to stop a 5-ton vehicle traveling at the rate of 20 mi. per hour in a distance of 15 ft. Traffic gates of the railway crossing type are used to halt the traffic before the steel nets are lowered.

The closed period of twelve months provided a much needed opportunity to recondition the machinery and electrical equipment of the bridge. A complete rebuilding of electrical parts included dynamic breaking, dead front control desk, automatic interlocks and new wiring throughout.

The improvements to the University Bridge, which have increased its capacity one-third or more, will also mean economy in maintenance with convenience of permanent and adequate construction. The personnel in charge of the project included: M. O. Sylliaasen, city engineer of Seattle; O. A. Piper, principal assistant city engineer; C. H. Eldridge, bridge engineer in charge of permanent approaches; and the writer, bridge engineer in charge of bascule improvements.



SPRAY PAINTING is the final operation in installing the open-mesh steel flooring.

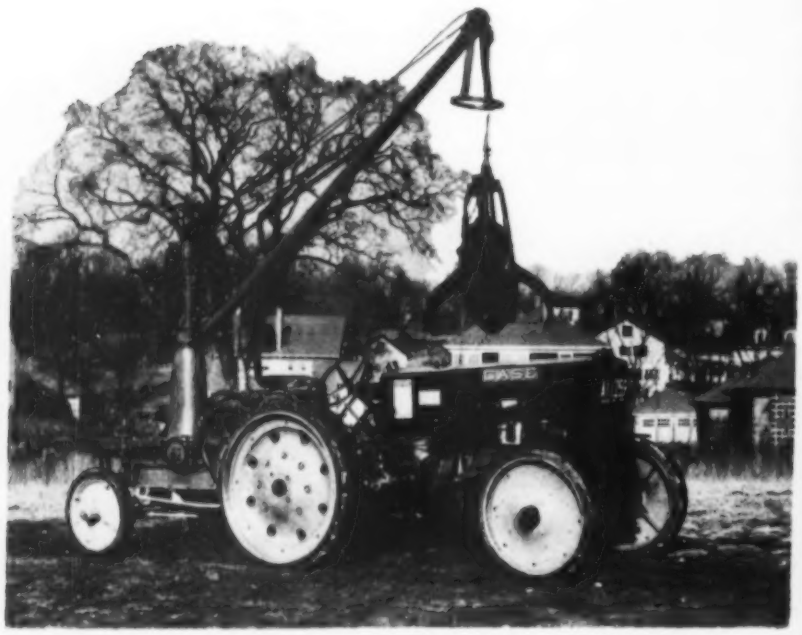
ELECTRIC WELDING is employed on the 6-in. channels for the outer roadway structure.

NEW OUTER ROADWAY *(below)* adding to width of bridge, is supported on brackets carrying stringers and 6-in. channels.

Getting Down to

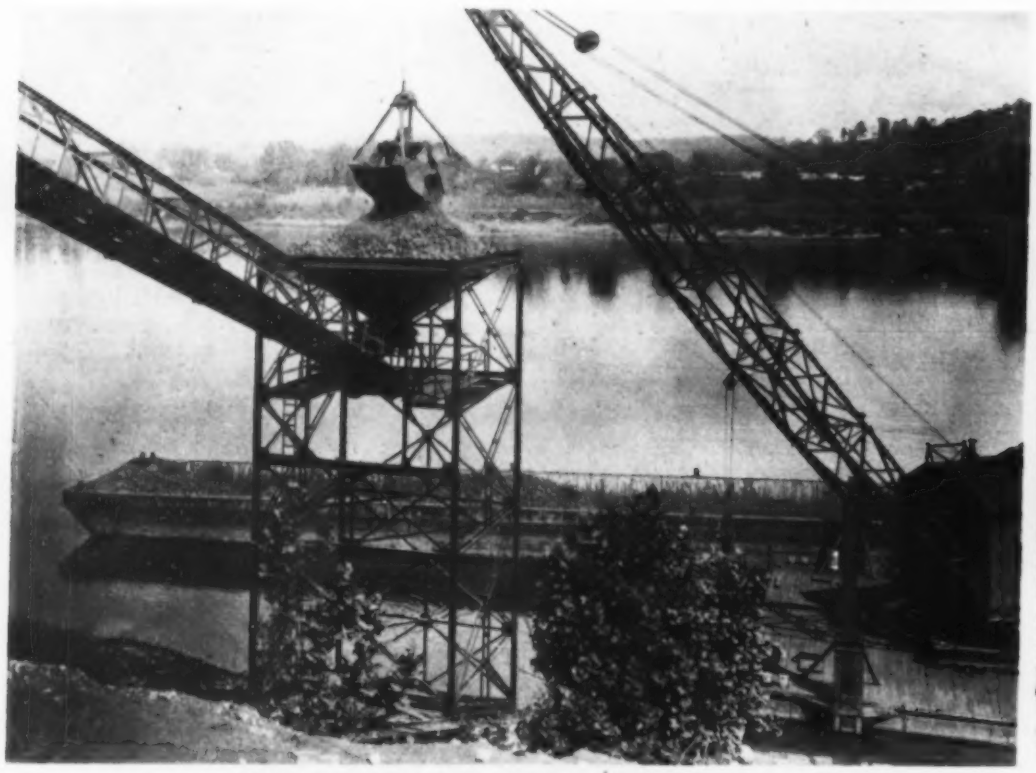
DETAILS

Close-up Shots of
Job Methods and Equipment



CATCH-BASIN CLEANER. City of Medford, Mass., develops mobile unit by rigging orange-peel bucket on Case industrial tractor.

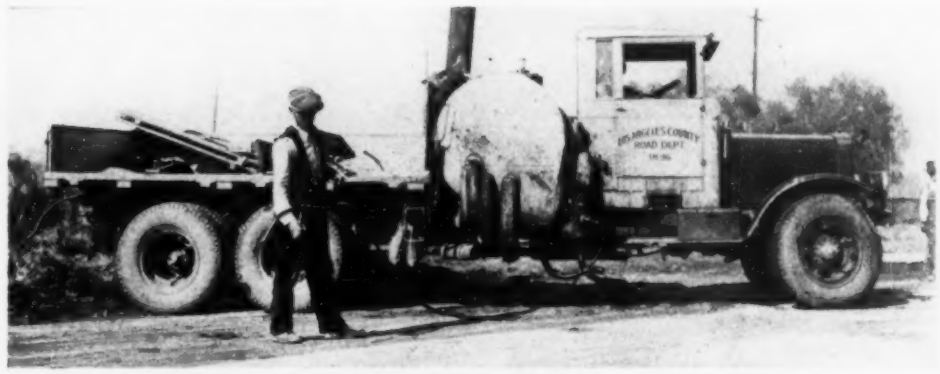
ADJUSTABLE GOOSENECK on 90-ft. boom of Link-Belt crawler crane facilitates speedy and accurate setting of stone for Senate Office Building in Washington, D. C. Contractor, B. F. Diamond, Baltimore.



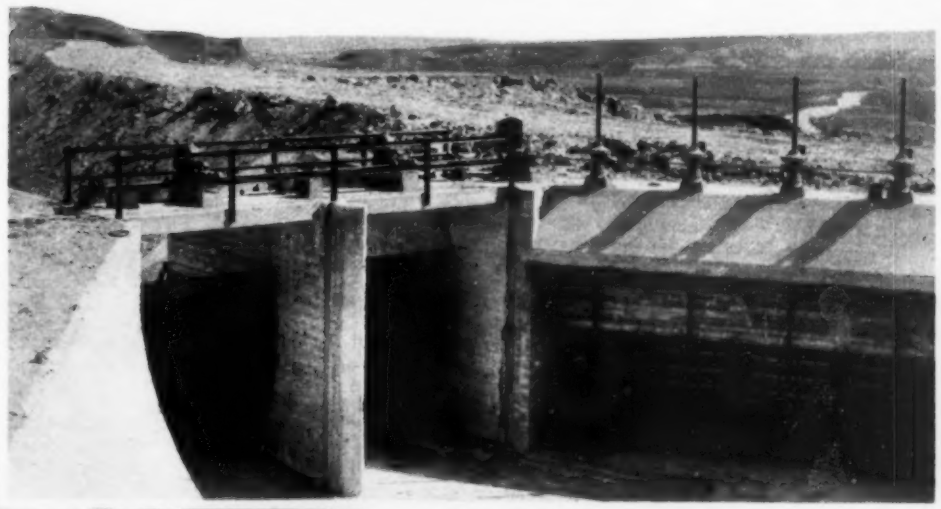
TO UNLOAD BARGES of coke along Ohio River at Ashland, Ky., American Rolling Mill Co. employs flexible material-handling plant *(left)* comprising a locomotive crane and clamshell bucket, movable elevated hopper and Jeffrey belt-conveyor system. The crane is mounted on a floating wharf. To accommodate varying water levels the receiving hopper is carried on a steel tower which may be moved up or down the river bank on an inclined track *(right)* so as to be always within reach of the crane boom and bucket.

TURN-AROUND WITHIN FORMS. In grading Illinois state roads south of Chicago, Allis-Chalmers tractor, hauling 1-yd. Western tumble-bug scraper, is able to maneuver within the 20-ft. width between the forms for concrete pavement.

PERISCOPE simplifies inspection of foundation rock strata through drilled holes at Marmet Lock on Kanawha River, West Virginia. Apparatus consists of 2-ft. length of 2½-in. stove pipe equipped with electric light bulbs and mirrors.



ROAD-PATCHING TRUCK employed by Los Angeles County Road Department, California, is equipped with oil-spraying tank, heated by motor exhaust, and body for crushed stone. Oil is sprayed by power-driven pump.



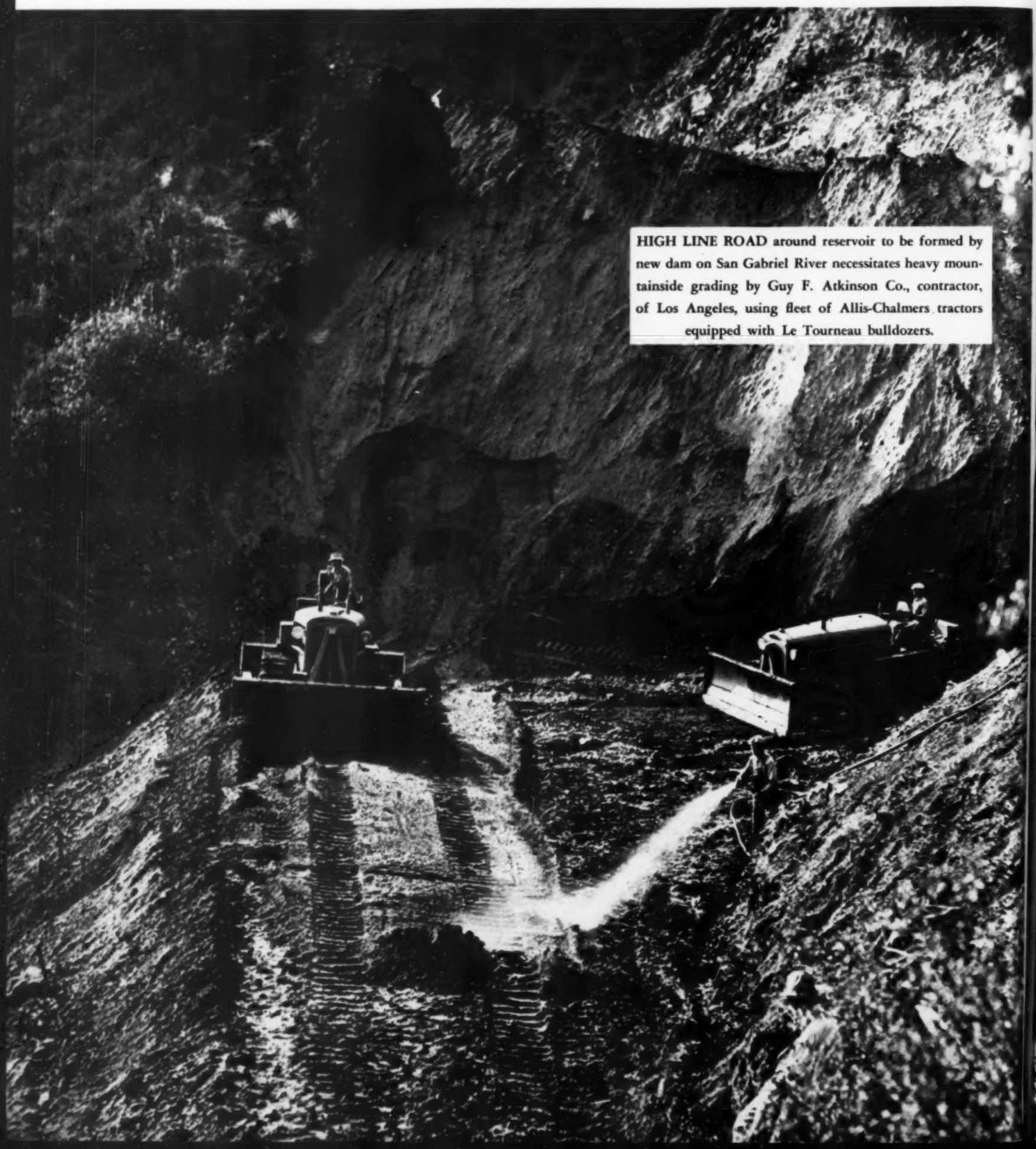
MECHANICAL OPERATION of wasteway gates on Owyhee North Canal in Oregon, located far from electrical power lines, is accomplished with aid of gasoline engine from Ford car. Tedious hand operation of gates is avoided by applying engine power through bevel gears to gate shaft pinions.

Wide World Photo

X-RAY MACHINE, *(left)* mounted on wheels, is used to check soundness of electric welds on huge steel penstocks for Boulder dam, being fabricated in shops of Babcock & Wilcox Co. at damsite. General Electric apparatus, rated at 300,000 volts, can produce radiographs of welded steel plate 4 in. thick.

Highway and Dam Construction in California's

SAN GABRIEL CANYON



HIGH LINE ROAD around reservoir to be formed by new dam on San Gabriel River necessitates heavy mountainside grading by Guy F. Atkinson Co., contractor, of Los Angeles, using fleet of Allis-Chalmers tractors equipped with Le Tourneau bulldozers.

SAN GABRIEL DAM No. 2, 10 miles upstream from Dam No. 1, is rock-fill structure 255 ft. high above streambed, 785 ft. thick at the base and 580 ft. long on the crest. It is being built at cost of $2,087,000 by Macco-Lewis, Inc., of Clearwater, Calif., for Los Angeles County Flood Control District, E. C. Eaton, chief engineer.

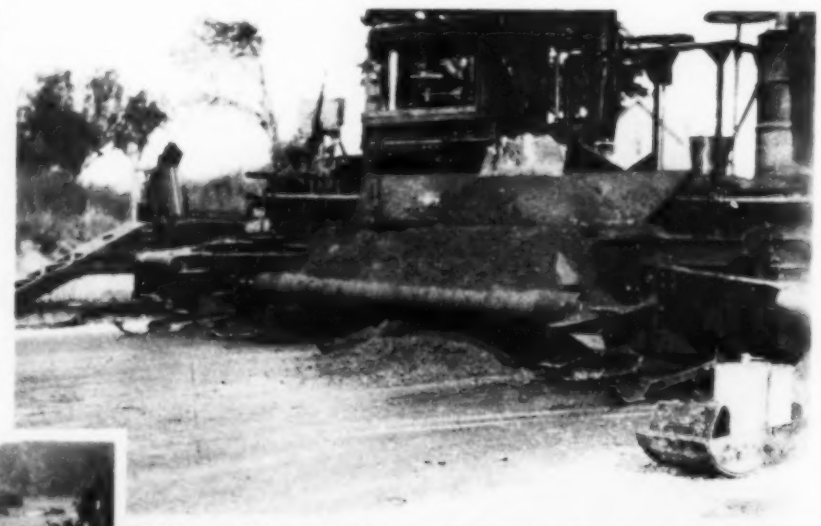
CRAWLER-MOUNTED FINISHING MACHINE spreads and compacts rock asphalt wearing surface varying in thickness from as thin as 1/3 in. at center to as deep as 3 in. at edge on old bituminous pavement. No forms are required.

Crawler-Mounted Finisher

Builds Bituminous Roads Without Forms

AN automotive crawler-mounted mechanical spreader and finisher last year distributed and compacted bituminous materials on two Indiana reconstruction projects aggregating 25 mi. in length. On the first of the two projects, the machine spread more than 4,300 tons of bituminous-coated aggregate in a leveling course averaging 1½ in. thick over a length of 6 mi. in 24 working days at an average rate of 189 tons per day. On the second project, the finisher distributed rock asphalt at about 150 deg. F. in a wearing course of average 1-in. thickness, requiring more than 10,400 tons of material for 19½ mi. of 18-ft. road. This work was completed in 21 working days at an average rate of 497 tons per day. Planing and rolling followed the finisher on both projects.

Mechanical Finisher—On these projects the maintenance division of the Indiana State Highway Commission used a Barber-Greene bituminous finisher designed to spread and compact bituminous-coated aggregate, rock asphalt or other bituminous mixture. The finisher consisted primarily of: (a) a hopper in front at the center of the machine to receive the material and a screw conveyor to convey it uniformly across the full width of the pavement being laid; (b) a tamper and a screed; (c) a frame on which was supported the tamper and screed and which contained a power unit consisting of a 48-hp. gasoline engine with a manually controlled governor; and (d) two crawler tracks and a shoe on either side supporting and propelling the machine. An outstanding feature of the finisher was its ability to produce a smooth surface without the use of forms. The crawlers and shoe were connected by means of evener levers in such a manner that any unevenness in their path had a very reduced effect on the unevenness of the surface of the finished road. Ordinarily care in preparing a smooth shoulder for the crawler and shoe to travel over resulted in a smooth-riding surface. A 6-in. metal roller mounted in front of the hopper pushed against the rear wheels of the truck, thus shoving it forward as its load dropped into the hopper. The crown of the finished surface was readily changed by adjustments that were made easily.



6-IN. METAL ROLLER mounted transversely in front of finishing machine pushes against rear wheels of truck, shoving truck ahead while load dumps into hopper behind roller.

ON LEVELING COURSE *(below)* of bituminous-coated limestone aggregate spread and compacted to smooth surface by finishing machine, workmen distribute rock asphalt by hand for 2/3-in. compacted wearing course.

Although the finisher could travel as fast as 24 ft. per minute, it was found that to go faster than 17 ft. per minute in laying the rock asphalt was not satisfactory because the "pulling"

effect of the screed upon the asphalt left the surface open and porous. When the steam-heated rock asphalt was cooler than 140 deg. F. this "pulling" effect was more noticeable. No attempt was made to lay cold rock asphalt. It is believed, however, that cold material might lay better than material heated just enough to produce a "sticky" condition that contributed to the "pulling" and produced an open surface. With the machine traveling 17 ft. per minute and making stops for normal delivery of material, it averaged better than 0.1 mile per hour.

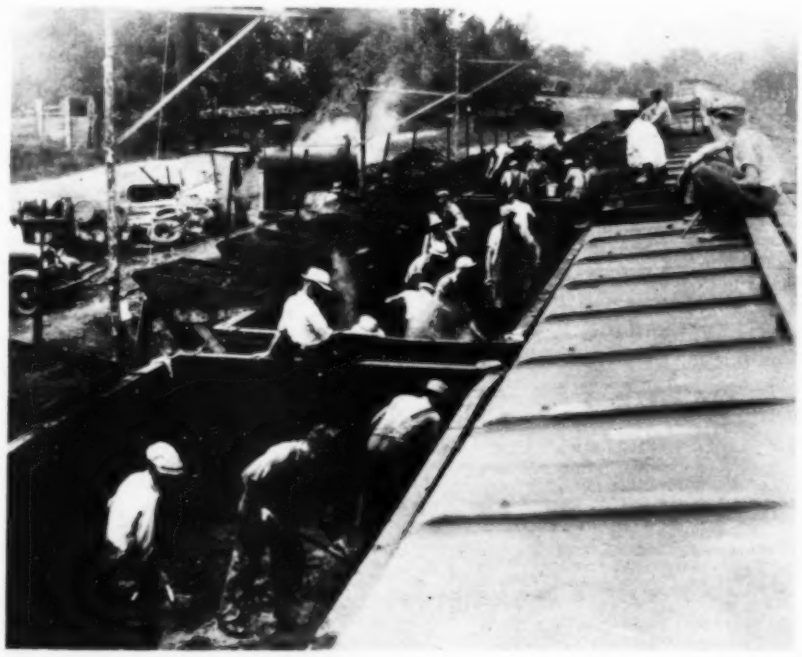
Widening at Curves—The finisher used was built to lay a standard width of 20 ft., but by the use of baffle plates on either side, a shorter width could be laid. The standard widths on the two projects were 19 ft. on the bituminous-coated aggregate and 18 ft. on the rock asphalt wearing course. Additional widths were provided on curves by two methods. An added width of 6 in. on a side was obtained by opening side doors in the baffle plates, thus allowing material to spill out over the edge. This material was leveled by hand. Greater widths than 6 in. were obtained by shoveling material from in front of the tamper to the edge of the pavement.

First Project—On the first project, 6.09 mi. long, a bituminous-coated aggregate leveling course of about 1½ in. average compacted thickness was necessary to take out the excess crown and strengthen the old base. On this project the finisher was used only in laying the leveling course.

The bituminous-coated aggregate in the leveling course was made from 1½- to ¾-in. crushed limestone, coated with emulsified asphalt by the immersion process at the quarry site, hauled an average distance of 19 mi. and dumped into the hopper of the finisher, which spread and compacted it to the desired crown.

After being laid with the finisher, the coated aggregate was first rolled with a 5-ton, three-wheel roller followed by a 10-ton roller. Then ¾-in. coated aggregate was spread over the surface at the rate of about 100 cu. yd. per mile, and the surface was dragged with a maintainer that had been lengthened by using 30-ft. I-beams instead of the regular side frames. This maintainer was pulled by a 20-hp. tractor. After this planing of the ¾-in. coated aggregate, the surface was again rolled as a final operation before laying a rock-asphalt course.

By modifying a standard maintainer to a longer base it was possible to produce a smooth-riding surface in cold-laid bituminous-coated aggregate. The longer-base machine contributed greatly to building a smoother riding surface free from the "bumps" and "throws" not uncommonly experienced at high speed in bituminous surfaces laid on old roads.



ROCK ASPHALT steam-heated to about 160-deg. F. in gondola cars is shoveled into hoppers suspended on side. Material dumps from hoppers into trucks, eliminating delays in loading trucks.

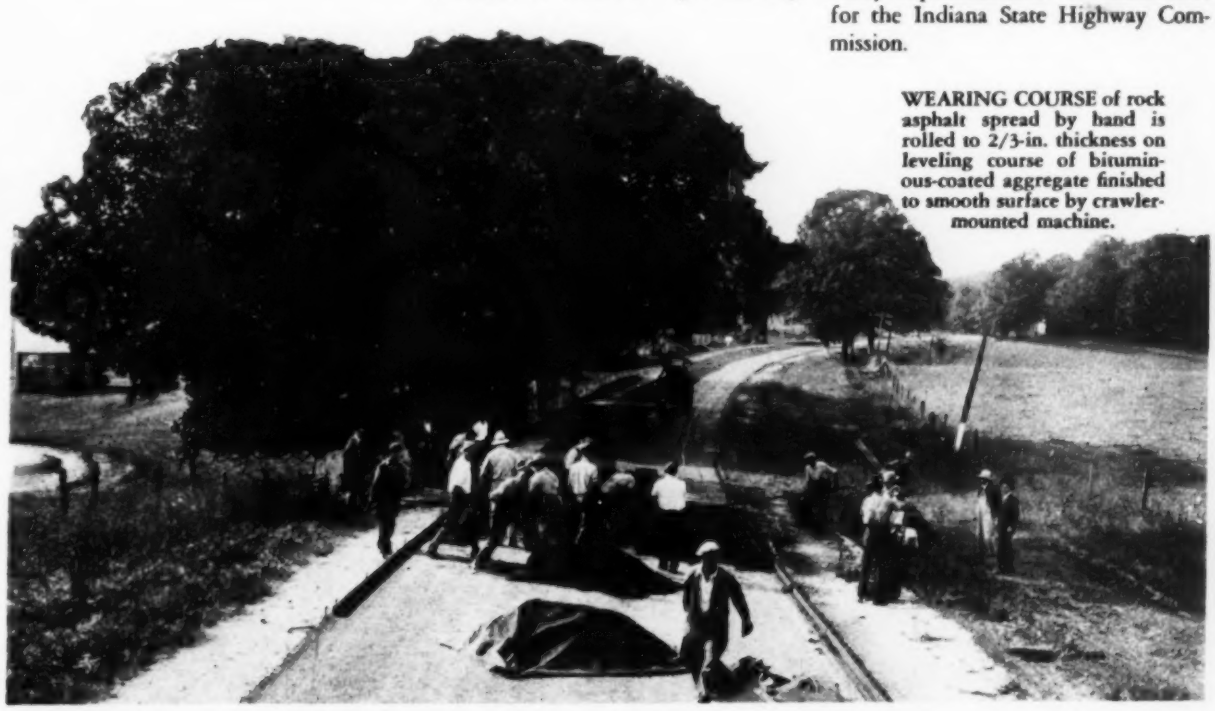
LONG-BASE MAINTAINER extended to greater length by welding on additional members provides better riding surface in dragging gravel and stone surfaces and eliminates bumps in bituminous surfaces laid on old roads.

It was not deemed necessary to use the finishing machine on the rock-asphalt wearing course of the first project, as the leveling course had been built so smooth with the finisher that it was easy to construct by hand a smooth-riding wearing course.

Laying Rock Asphalt—On the second project, 19.49 mi. long, the old bituminous macadam was first carefully patched with bituminous-coated aggregate. The surface was then given a treatment of about 1/20 gal. per square yard of cutback asphalt, from 2 hr. to 2 days before the rock asphalt was laid. Rock asphalt of sandstone base was shipped by rail from a plant in Kentucky and trucked from the railroad station to the work—an average haul of 9 mi. It was laid by the bituminous-finishing machine without the use of a leveling course. An attempt was made to take out any remaining roughness and the excess crown in the old surface by the use of a thicker course of rock asphalt than was used in the first project. Because of the excess crown and variations in the old surface, the rock asphalt (which averaged about 1 in. in thickness, or 97 lb. per sq.yd.) varied from as thin as 1/3 in. in some places in the center to a thickness as great as 3 in. at the edge.

Rock asphalt laid with the finisher in the second project was planed with a maintainer which had been lengthened by welding 8-ft. extensions to the side frames, thus increasing the length of base of the maintainer in contact with the road surface from 14½ to 22½ ft. This extended maintainer was pulled by a 3-ton truck. The rock asphalt surface was rolled once before the planing started. A process of adding rock asphalt, planing and rolling was continued until a sufficiently smooth surface was produced.

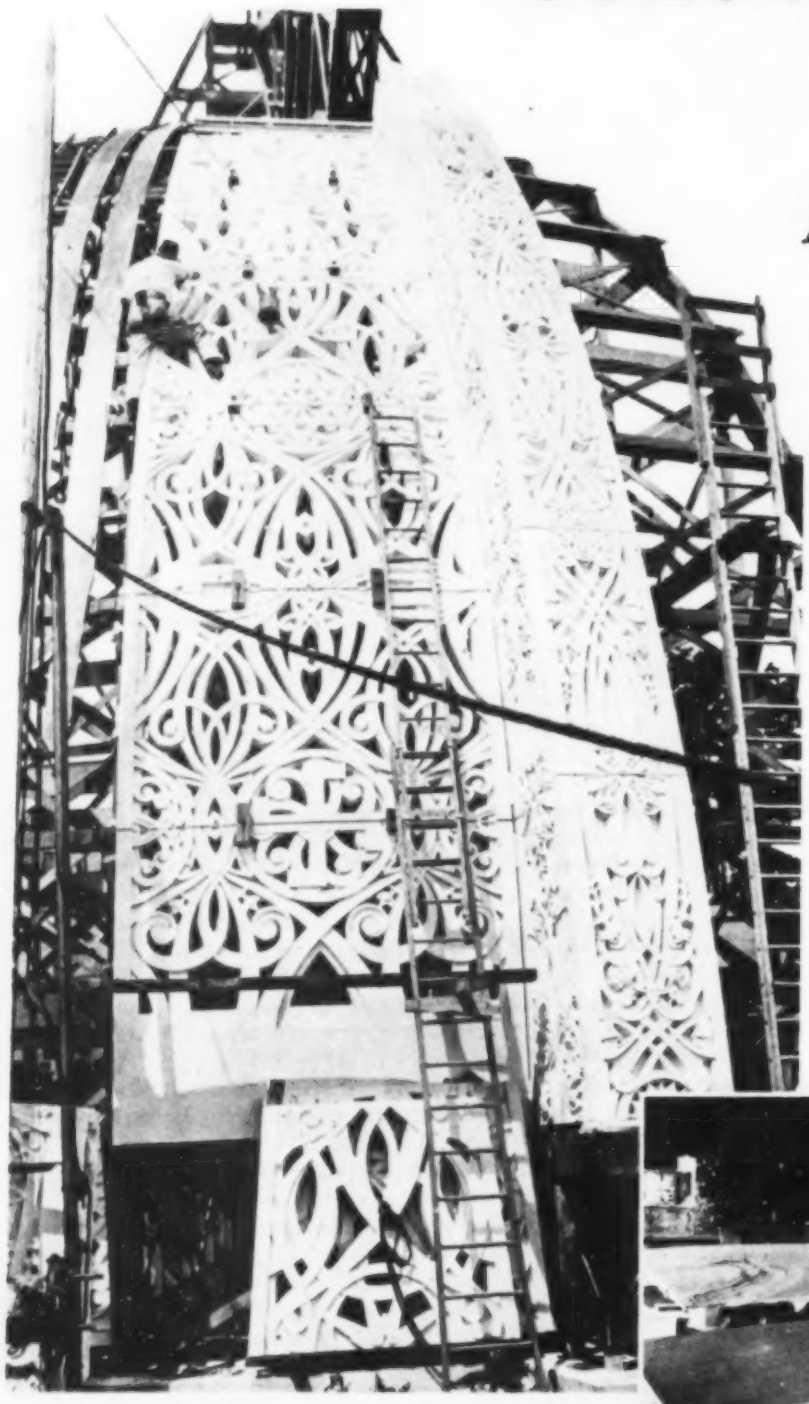
Information contained in these notes and photographs accompanying them were supplied by A. H. Hinkle, formerly superintendent of maintenance for the Indiana State Highway Commission.



WEARING COURSE of rock asphalt spread by hand is rolled to 2/3-in. thickness on leveling course of bituminous-coated aggregate finished to smooth surface by crawler-mounted machine.

COLORED CONCRETE

Made From Sculptured Models

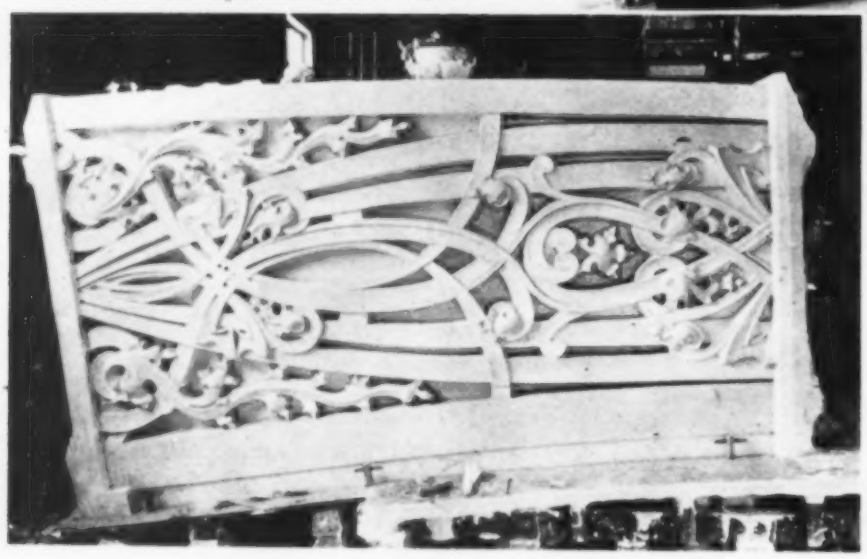


BAHAT TEMPLE, a universal house of worship, is a unique edifice standing on a promontory on the western shore of Lake Michigan in the village of Wilmette, Ill., about 15 mi. north of the Loop District of Chicago. This structure has been in the course of erection since the nine concrete foundation caissons were sunk to bedrock, 124 ft. below the ground surface, in 1921. The foundations were completed in the summer of 1922, and the superstructure was built in 1930 and 1931.

Original plans for construction of the Temple, the final cost of which was estimated at $1,250,000, contemplated building the structure in four sections as funds became available: the foundation structure, the first story, the second story, and finally the clerestory and dome. When funds to the amount of $400,000 became available in 1930, however, The Research Service, of Washington, D. C., engineers for the Temple trustees, made a study of the practicability and economy of constructing the superstructure framework complete and subsequently clothing this framework with the ornamentation, which virtually constitutes the architect's design. As a result of this investigation, it was decided to build the entire superstructure framework, housed in with doors, windows and glass dome. In accordance with the revised plan, the superstructure was built between September, 1930, and May, 1931, by the George A. Fuller Co., general contractor, and 24 subcontractors, as described in Construction Methods, August, 1931, pp. 46-48. This work was completed with a saving of about $30,000 over the estimated cost of the project, in addition to savings of about $50,000 effected by elimination of temporary roofs, main floor platform, skylights and other details of the original design.

In June, 1932, a contract for the dome ornamentation was awarded to John J. Earley, of Washington, D. C. Over a period of about 12 years a board of advisory engineers has been making a thorough research into the field of materials for exterior ornamentation. Existing structures in this country and abroad were examined, and tests were made of such materials as natural stone, cast stones, architectural concrete, metal alloys and terra cotta by making sections of the ornamentation and exposing them over a period of several years on the Temple property. These investigations, including tests for practicability, adaptability, durability, weathering, cost, color control and discoloration, led to the final selection of a special type of architectural concrete developed by the Earley Studio.

TO MAKE MOLDS for casting colored concrete dome ornamentation, plaster of Paris models are placed on timber frame which reproduces section of dome.



WOODEN FORMS of proper curvature afford base for 5-in. clay layer used in making original models of dome ornamentation.

PLASTER MODEL OF RIB *(left)* ready for making final plaster of Paris mold in which concrete will be cast.

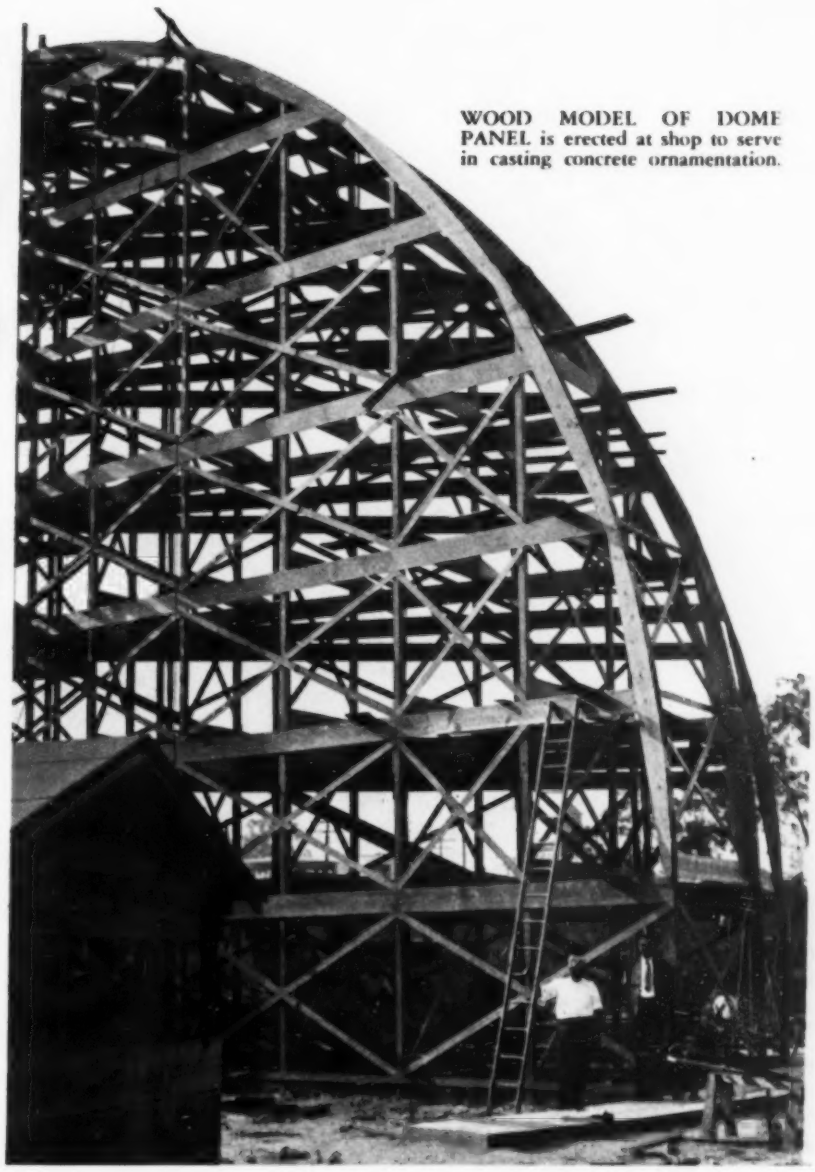
CASTINGS

Cover Unique Temple Dome

By A. B. McDANIEL
Director, The Research Service
Washington, D. C.

Apparently the architect, Louis Jean Bourgeois, designed the Baha'i Temple to be built of natural stone, pierced and carved to resemble the pattern of the lace-like Taj Mahal. Use of such surface material, however, would be prohibitive because of the time, effort and labor involved. Concrete, on the other hand, has the adaptability, durability and strength to meet the peculiar and exacting requirements of the Temple ornamentation. Color control also is an important requirement of the exterior surface material, as the architect's conception contemplates a structure varying from a pure white at the top of the dome to a cream at the foundation. A field investigation involving examination of twelve quarries and outcrops of quartz and extending over a period of several months resulted in locating two deposits of suitable materials; an opaque white quartz and a clear, radiant, crystalline material. These materials were crushed into a graded aggregate and used in the proportions of about one-third of the crystalline quartz to two-thirds of the opaque white material with white portland cement to form the cast sections of the concrete ornamentation. Several plaques of various mixtures of quartz from different localities were made similar to the material to be used in the ornamentation, and the surface appearance and durability of these samples were studied under outdoor conditions of lighting and weathering. As a result of this test, materials were selected that will give a white, radiant and impervious surface for the entire ornamentation for the dome.

Construction of the dome ornamentation was begun in June, 1932, at the Earley plant in Rosslyn, Va. As this project is a pioneer in this type of building construction, without precedents to follow or similar structures to copy in the use of methods and materials, it was necessary to develop first a plan of procedure which could be carried out step by step and modified from time to time as experience required. The first step was the design, layout, and construction of a braced timber framework which reproduced one panel of the present steel dome structure. A layout was made for the center, outer arc and transverse sections of the dome panel on concrete slabs, center lines, slab sections, and dimensions being marked with different colored paints. Upon the panel layout was projected upward the timber framework, the outer portions reproducing the curved ribs and purlins of the outer steel structure of the dome.

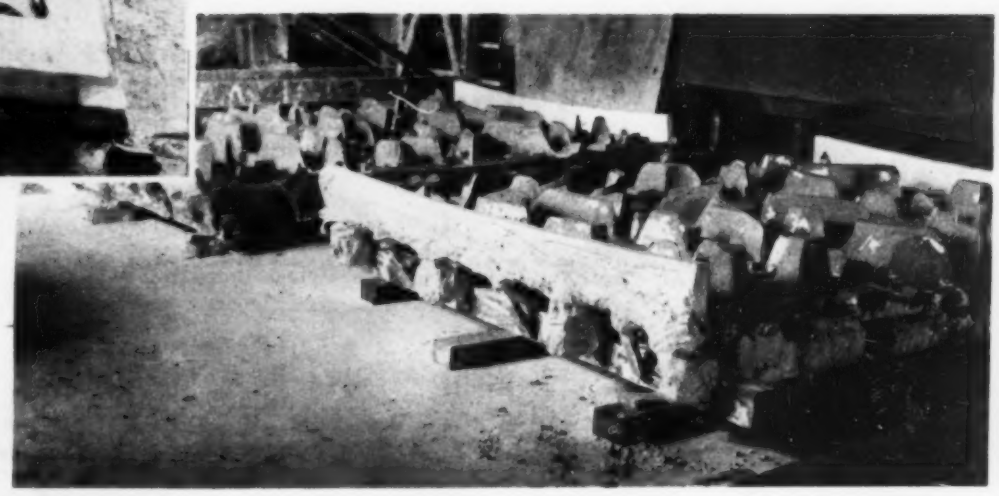


WOOD MODEL OF DOME PANEL is erected at shop to serve in casting concrete ornamentation.

Upon the completion of this timber model, wooden templets of the form of the outer surface were made and taken to Wilmette and compared with the steel structure. Astonishingly slight variations in the dimensions were noted and allowances made in the timber model. This model has served as a "yard stick" for making the models and molds for the ten sections of each panel and thirteen sections of each rib and, also, for the design of the structural furring system which will support the sections of concrete ornamentation on the present dome steelwork. As the dome has nine ribs and 27 panels, it requires a total of 387 concrete sections, which will be cast and erected this year.

Manufacture of the models and molds is performed in a series of simple steps. Upon a wooden form having proper curvature and contours is placed modeling clay of the required thickness of 5 in. Over the clay is laid a tracing paper copy of the full-size design. A sculptor traces the lines through the copy into the clay surface and then carves and models the clay to the final design. A plaster of Paris

MOLDS FOR CONCRETE CASTS are made from plaster of Paris models.



MOLDS OF DOME PANELS *(right)* ready for casting concrete.

WORKMEN SCRAPE AND FINISH SURFACE of concrete casting after removing it from mold.

AFTER PLACING CONCRETE IN MOLD, workmen finish back of casting.

DETAIL OF OUTER SURFACE of concrete cast.

impression then is taken of the clay model, and the final model of plaster of Paris is cast. Outer surfaces of the model are carved by an experienced modeler to give the proper texture and contour to these surfaces.

The next step consists in making the molds from the models. These molds also are made of plaster of Paris and are strongly reinforced with iron pipe and hemp. Each panel mold is to be used for casting 27 concrete sections, and each rib mold will make nine concrete sections. When used for making molds, the models are placed on the timber framework of the dome and are painted with two coats of white lead for protection and preservation.

Casting is being done in an open shed about 350 ft. long extending from the permanent studio building to a railroad spur track. The molds are placed in a longitudinal line about 10 ft. on centers. Each mold rests on three concrete piers to furnish uniform bearing during the placing of concrete. Casting involves the following steps:

1. Placing concrete in the mold to form the exterior facing to a depth of about 2 in. and setting in the mold, on the fresh concrete, a welded frame of steel rod reinforcement. The rib molds are U-shaped, with a face and two sides, and require more labor and material than the simpler panel sections.

2. After 24 hr. the mold is removed by two 2-ton chain trolley hoists that operate on a traveling I-beam gantry.

3. On the third day, the sections are moved by the crane to a sprinkling chamber, where they are kept moist 2 weeks.

4. After 2 weeks' curing the sections are removed by the traveling crane and loaded in box cars for shipment to Wilmette, Ill.

Because of the convergence of the ribs and panels toward the top of the dome, the panels vary in width from 9 ft. 9¼ in. at the bottom to 1 ft. 3⅛ in. at the top and in length from 6 ft. 5¾ in. at the base to 8 ft. 10 11/16 in. at the apex. The estimated weights range from about 1,000 lb. to 1,500 lb. Rib sections converge in width from the base to the top of the dome and vary in length from the 19-ft. section of the clerestory to about 3 ft. 9 in. at the top of the dome. The clerestory sections will be cast in place on the structure, but the 117 dome sections will be made in molds at the plant.

GLASS DOME AND CLERESTORY of nine-sided temple having central auditorium with clear height of 138 ft. are being covered with colored concrete castings made from sculptured clay models.

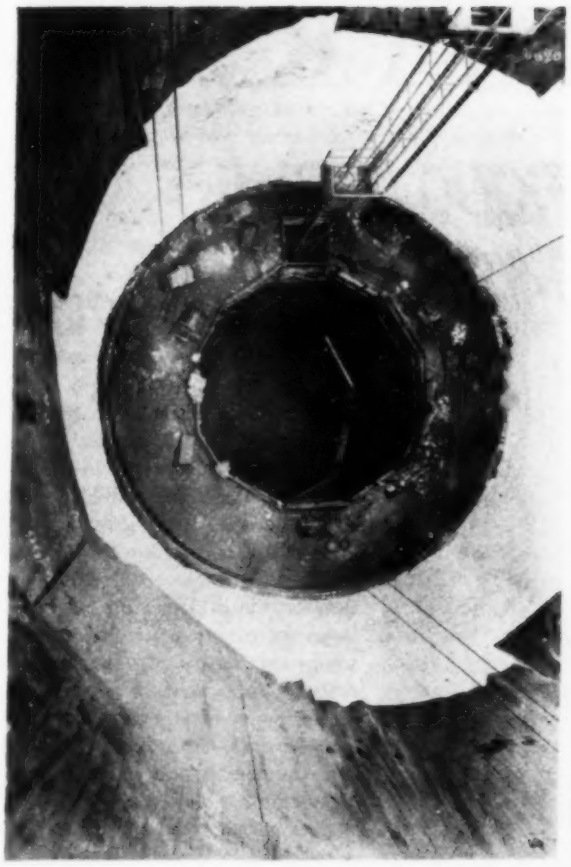
A special structural framework of steel T-shaped members is being fabricated and will be erected on the present ribs of the dome. The contact surfaces of the T's will be covered with a bituminous shield to prevent corrosive action of the alkali in the concrete on the steel. Lead sealing strips will be placed in the joints between the concrete sections to exclude light and moisture from the bituminous shields.

Initial casting of the sections began during the first week of May, 1933, at the Rosslyn plant and will continue during the summer and fall at a minimum rate of twelve casts per week. If funds permit, this rate of casting will be doubled. Casting of the great ribs of the dome began early in May with the placing of concrete in the molds on the clerestory of the structure. Each 19-ft. section requires about 1 week for setting up the molds, placing the concrete, stripping the molds, and moving them to a new section. If funds are made available, it is intended that progress shall be expedited to complete the dome ornamentation early in the fall of 1933.

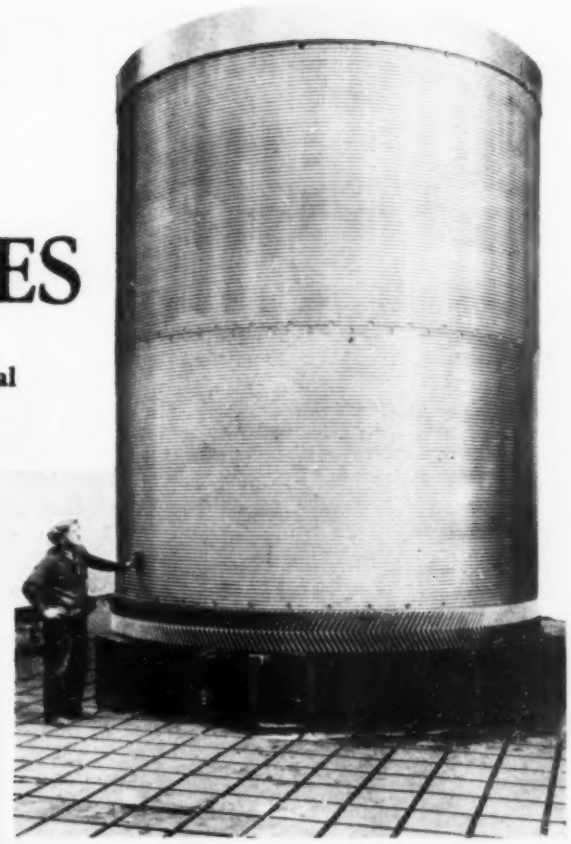
Supervision — John J. Earley of Washington, D. C., holds the general contract. Subcontracts have been awarded to Rouse & Shearer, Trenton, N. J., for quartz aggregate; to the Bethlehem Steel Co. and the McClintic-Marshall Corp., Bethlehem, Pa., for steel framing, and to the Worden-Allen Co., Chicago, Ill., and Milwaukee, Wis., for fabrication of the structural furring system. Engineering management and supervision are by The Research Service, of Washington, D. C., with the writer in direct charge.

JOB ODDITIES

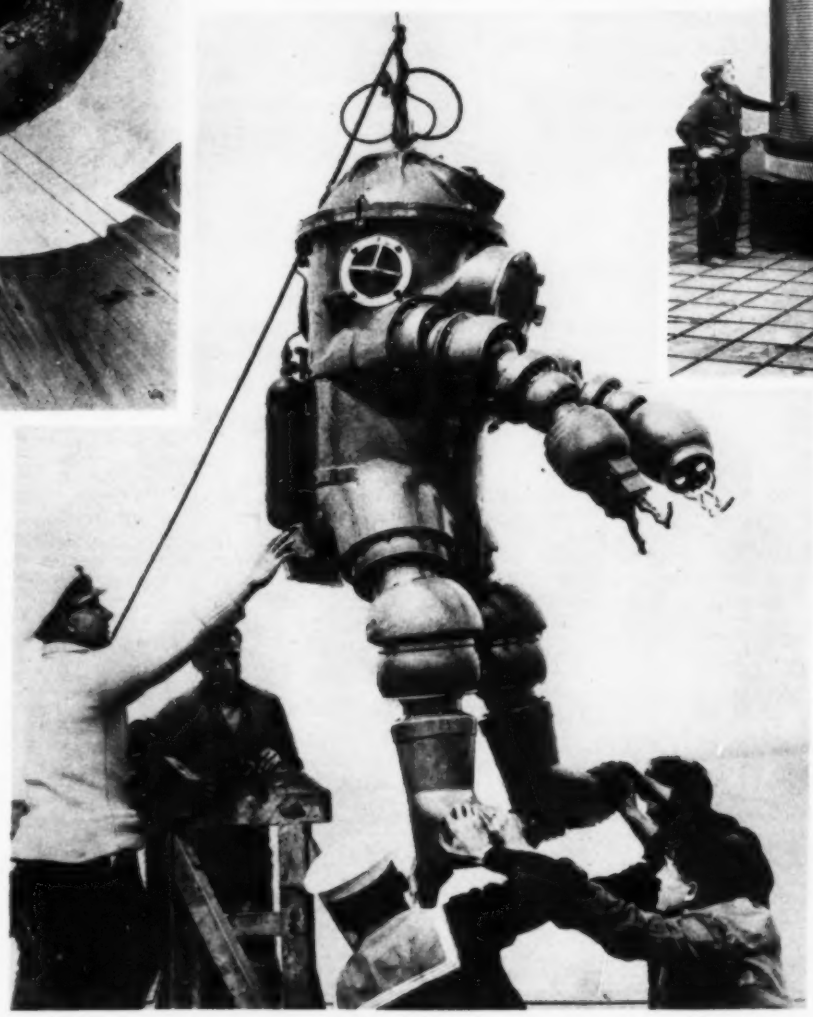
A Monthly Page of Unusual Features of Construction



RING OF ICE, 70 ft. in inside diameter and from 10 to 15 ft. thick, facilitates sinking of ventilating shaft for vehicular and pedestrian tunnels under Scheldt River at Antwerp, Belgium. Freezing process makes possible excavation to depth of 90 ft. through water-bearing material without use of bracing. Brine solution is circulated through system of vertical piping sunk to form two rings of 86- and 78-ft. diameters. Pipes in each ring are spaced 4½ ft. apart, circumferentially. Ice wall was maintained until the shaft was concreted. Consulting engineers on the project were Parsons, Klapp, Brinckerhoff & Douglas and Ole Singstad, of New York.

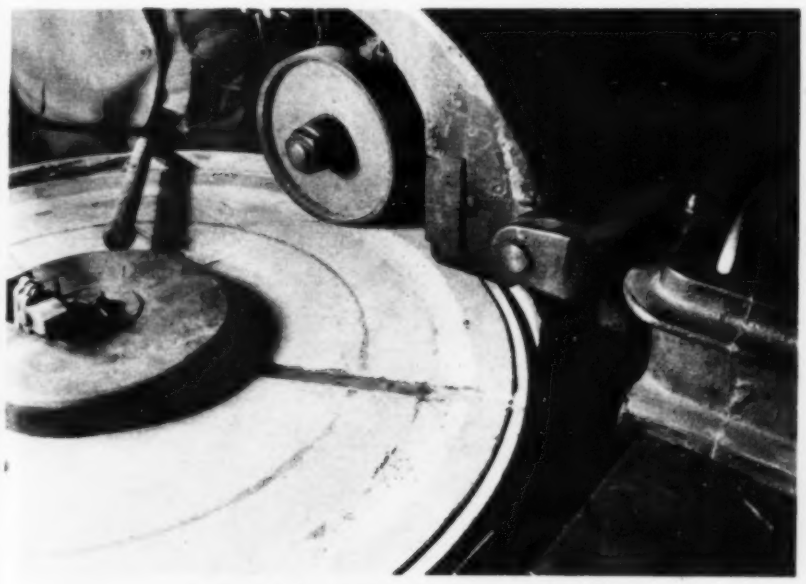


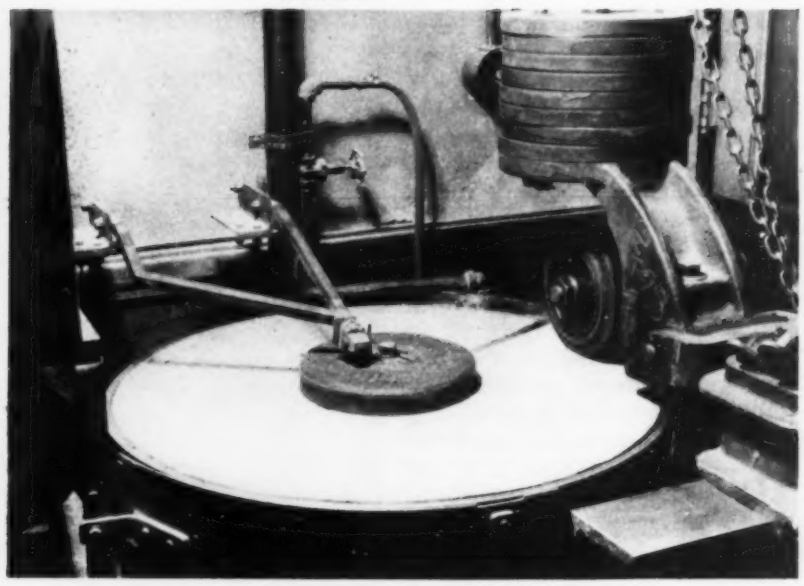
A DRUM THAT'S HARD TO BEAT. More than a mile of 1⅛-in. wire rope will encircle this 90,000-lb. grooved cylinder for the 150-ton Lidgerwood cableway at Boulder dam. Each of two hoist drums was rolled from 2-in. steel plate 42 ft. long and 8 ft. wide and fabricated by welding seams and internal strengthening structure with General Electric welding machines.



FOR DEEP SEA WORK *(left)*. British Admiralty tests steel diving apparatus of unique design. Diver carries own air supply compressed in tanks on back, eliminating air lines and pump. Arm and leg joints are flexible. Pincer-like claws act as hands.

Acme Photo





WAR OF ATTRITION is staged in testing laboratory of B. F. Goodrich Co., at Akron, Ohio, to demonstrate how concrete floor wear caused by metal wheels on industrial tractors (left) is eliminated by use of rubber tires (right). Metal wheels broke concrete at joint after 3,632 revolutions. Rubber-tired wheel showed no appreciable wear after 231,650 revolutions.

POWER LIFT TRUCKS

Deliver 7,000,000 Bricks to Scaffold Platforms

THREE industrial low-lift trucks and one high-lift truck enabled the George F. Driscoll Co., of Brooklyn, contractor for the construction of the U. S. Parcel Post building, New York City, to serve 125 bricklayers adequately with only 70 helpers. Practically all of the brick and mortar on the job, which required almost 7,000,000 bricks, were handled by lift trucks. The low-lift machines transported loaded skids to and from an inside platform hoist, of a special size to accommodate brick skids, and the high-lift unit transferred loaded pallets from the skids to the upper levels of the scaffolds. Mortar likewise was delivered by the low-lift trucks in pans on skids and was raised to the upper working platforms in special hoppers by the high-lift truck.

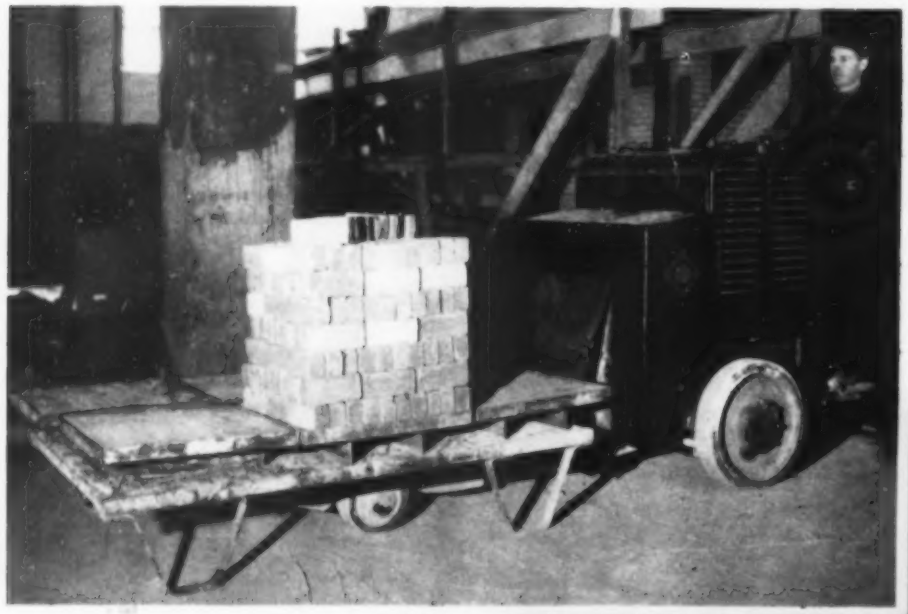
Dimensions of Building — Large floor areas and extremely high ceilings made the problem of distribution of materials for the 16-in. exterior walls and interior partitions of the Parcel Post building particularly important. The building occupies an entire block measuring 800 ft. long by 197 ft. wide, and the six full floors of the main portion of the building have ceiling heights averaging about 23 ft. An additional raised portion about 200 ft. square at one end of the building has four stories each about 13 ft. high.

Contractor's General Plan—Erection of the structural steel frame of the building had been completed under a subcontract before the George F. Driscoll Co. began construction of masonry. The work was carried on by constructing the building in three units of about equal floor area, starting at the lower end of the structure and completing the steel work, concrete floors and masonry work in the three units in sequence. These units were established by expansion joints directly through the building. A subcontractor installed the concrete floors in accordance with this schedule.

A plant to mix mortar and deliver brick and mortar to the upper floors was set up in the first unit and later was moved to the third unit. The entire operation was handled from these two set-ups. Bricks were delivered by trucks on the first floor of the building and were unloaded by hand either on to skid platforms or on to pallets for later handling by the high-lift truck. Low-lift trucks moved the loaded skids on to the platform hoist, which had a capacity of two skids, and similar lift trucks on the upper floors moved the skids from the hoist to their destination at the points where work was in progress on the exterior walls. The high-lift truck picked loaded pallets off the skids and deposited them on the upper tiers of the interior scaffold, from which bricks were distributed as needed to the exterior hanging scaffolds.

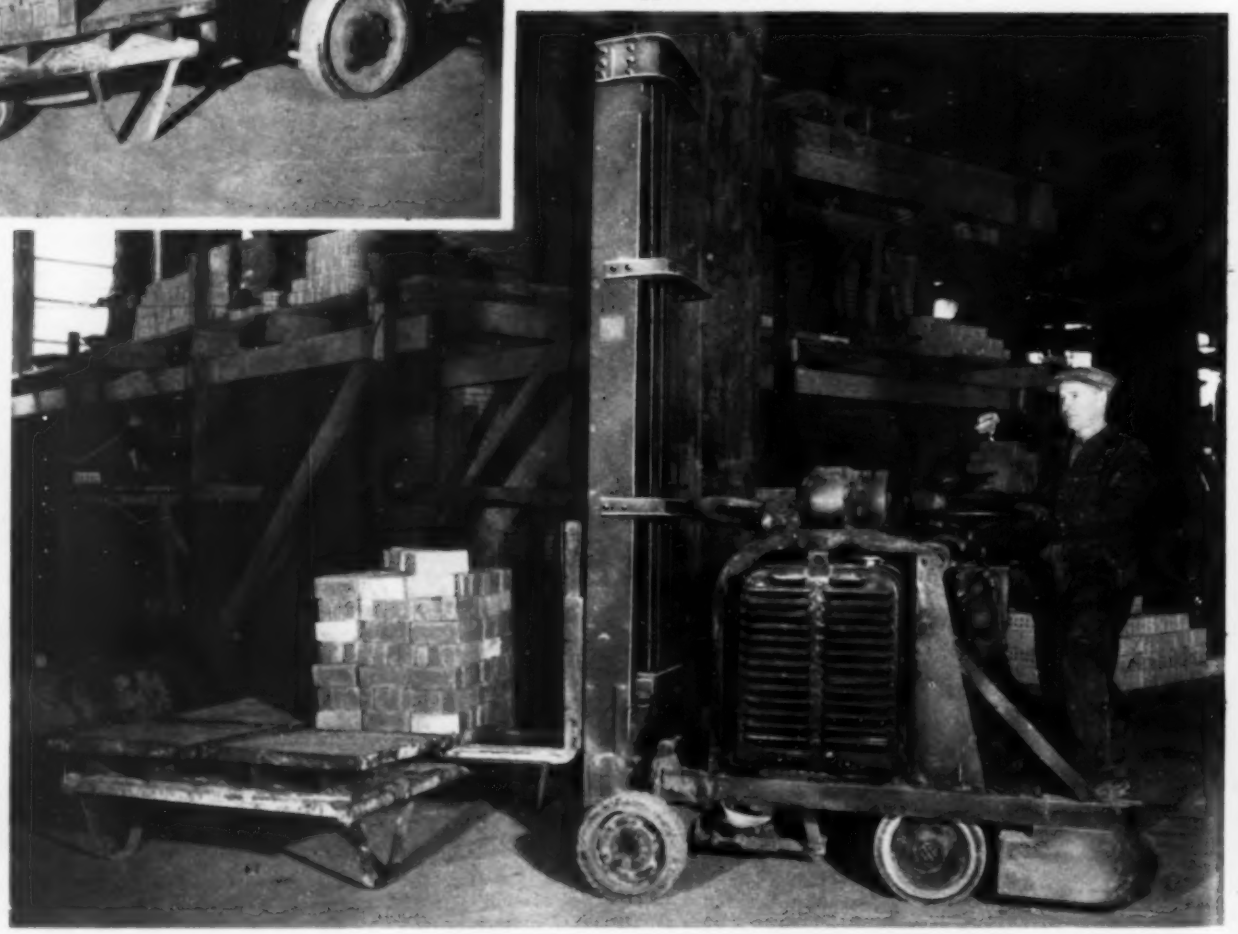
Power Lift Trucks—Low-lift trucks employed in moving skids to and from the platform hoist were Elwell-Parker gasoline-electric units of 6,000-lb. capacity. The skid platforms, of which the contractor had 150 on the job, measured 48x72 in. and had a clearance of about 12 in. above the floor. Each skid carried from 1,100 to 1,300 bricks when the units were loaded directly on the skid platform. The same loads were transported when pallets were used, six pallets being carried by each platform. Each pallet, measuring 24 in. square, carried a load of 180 to 210 bricks, depending upon whether glazed, enamel, face or common brick was being handled. A skid load of six pallets carrying common brick totaled 1,260 bricks. About 100 pallets were in service on the job.

To place the pallets on the upper scaffolding, the contractor used an Elwell-Parker gasoline-electric high-lift truck of 1,000-lb. capacity with telescoping uprights which gave a maximum lift of 15 ft. As illustrated by the accompanying photographs, the uprights carried a two-pronged fork which



GASOLINE-ELECTRIC LOW-LIFT TRUCK *(left)* picks up skid platform carrying six brick pallets, one of which is loaded with 220 bricks. Vertical steel-plate supports under brick pallets permit high-lift truck to pick up pallets on tines of hoisting fork.

HIGH-LIFT TRUCK *(below)* slips tines of fork under loaded brick pallet on skid platform, preparatory to raising bricks to upper scaffold level.

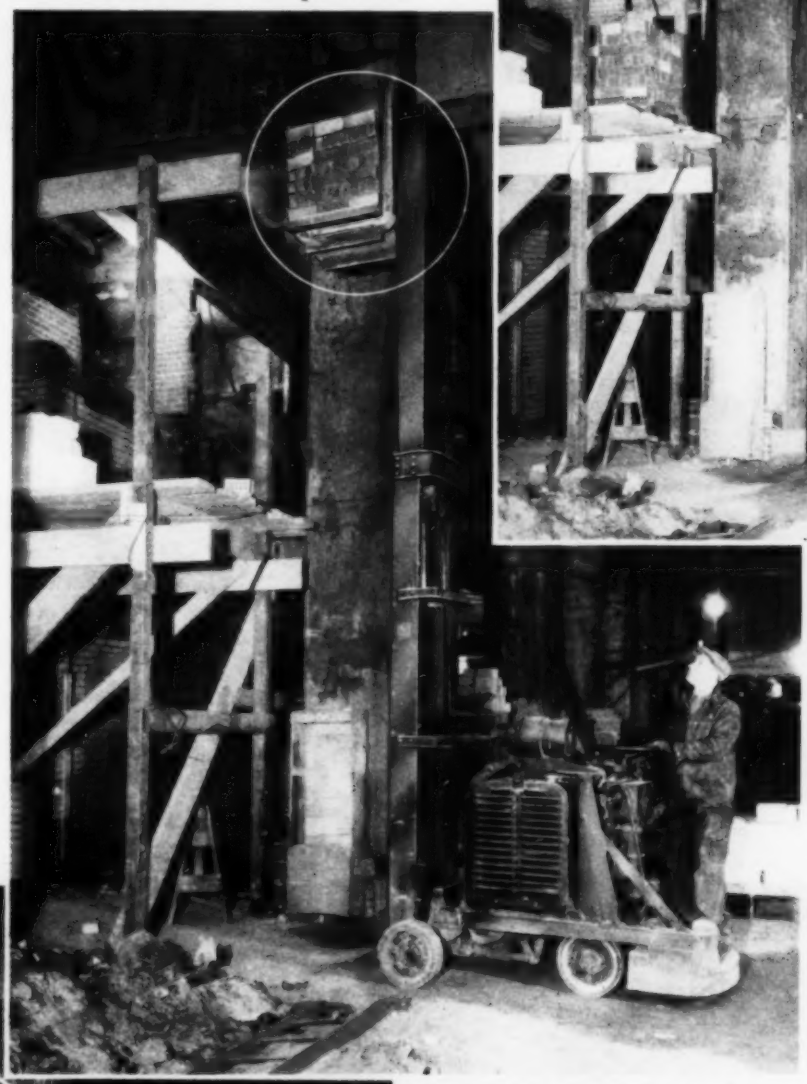


picked up the brick pallets from the skid and deposited them on the working platform. The telescoping uprights could be tilted forward 8 deg. and backward 15 deg., enabling the operator to center the load over the driving wheels, as in a cradle, when moving any distance.

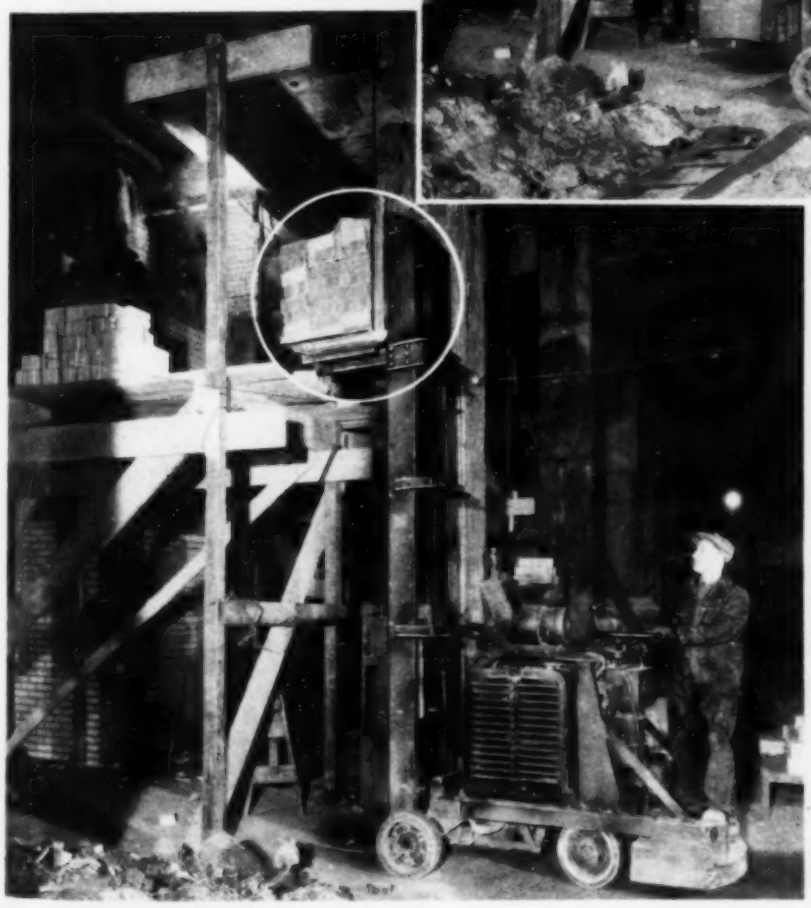
Handling Mortar—Mortar was discharged by the mixer drum into mortar pans of 18-cu.ft. capacity which were loaded on skid platforms and transported by the low-lift trucks and the hoist to a position near the bricklayers on the upper floors. When the mortar was to be used by the bricklayers in laying the first lift of a wall, the helpers shoveled the material into mortar tubs and distributed the tubs at convenient locations. When intended for the upper portion of a wall, however, the helpers shoveled the mortar into special 8-cu.ft. hoppers, of the type shown in one of the photographs, which were raised to the upper platforms by the high-lift trucks, and the mortar was discharged directly into the mortar tubs on the scaffold by opening the hopper gates. The contractor used 50 large pans and four 8-cu.ft. hoppers to deliver mortar to the bricklayers.

Scaffolding — In carrying on this masonry construction with the aid of the high-lift truck, the scaffold around the interior of the building was made only wide enough for actual working conditions, in contrast with the greater width which would have been necessary had wheelbarrows been employed. Use of wheelbarrows also would have required additional scaffolding to support runways from the hoist to the walls. By substituting lift trucks for wheelbarrows, the amount of scaffolding was reduced by more than half.

In moving scaffolding from floor to floor, the large platform hoist, 5½ x 14½ ft. in size, was used to accommodate special loaded skids. It was found economical to load planks and poles from the scaffold on skid platforms with wheels attached. These platforms were pushed directly on to the hoist platform and taken to the upper floors. In this way, the passing of scaffolding from floor to floor was avoided.



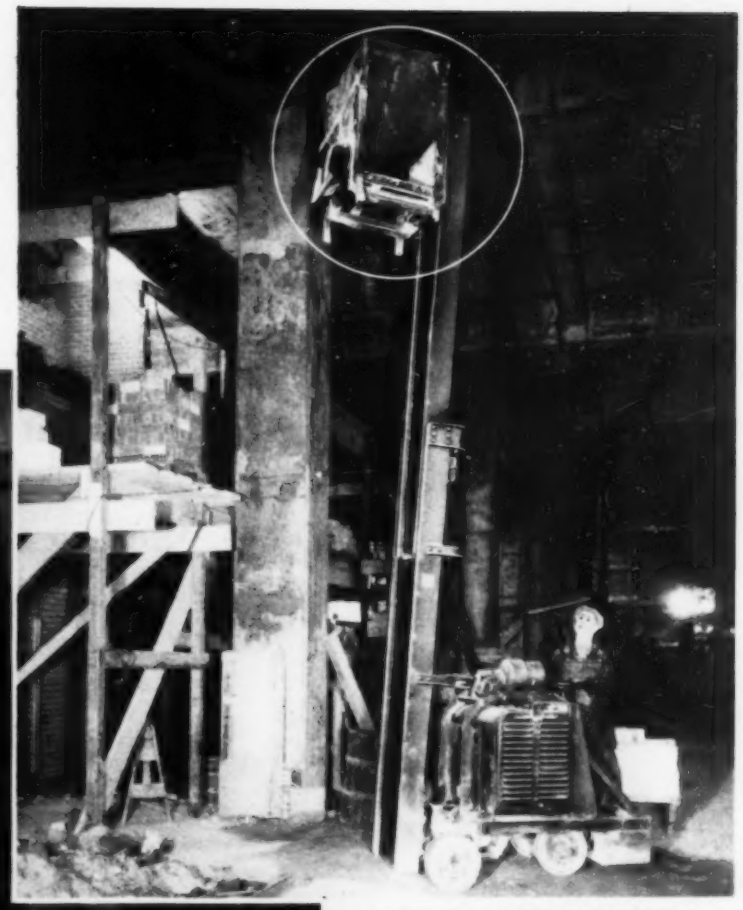
BRICK PALLET *(below)* is delivered to scaffold platform by high-lift truck, which deposits pallet, releases fork and backs away. Truck averages 50 deliveries an hour.



TELESCOPIC UPRIGHTS of high-lift truck, extended to full height of 15 ft., can deposit brick pallet on topmost scaffold platform.

Operating Cycle of High-Lift Truck —It is estimated that two-thirds of the bricks and mortar used on the job was handled by the high-lift truck. The contractor alternated bricklaying operations, tier by tier, on opposite sides of the building, and the high-lift truck ordinarily completed delivery of brick pallets to a working platform before the bricklayers moved to it. As a full bricklaying crew averaged about 200 men, of whom more than 125 were bricklayers and about 70 were helpers, the truck had to make about 400 lifts of brick pallets per day, in addition to deliveries of mortar.

Over a large part of the work, the high-lift truck maintained an average of 50 lifts an hour with brick pallets. At one place, raising the pallets to a working platform 14 ft. above the floor, the truck averaged 60 lifts an hour. The truck required about 1½ min. for the complete cycle involved in lifting and discharging an 8-cu.ft. mortar hopper. Usually the hoppers were emptied and immediately returned to the floor by truck. Occasionally, however, a hopper was left temporarily on the working platform to be discharged and later returned to the floor.



8-CU. FT. MORTAR HOPPER is raised to full 15-ft. height of telescopic uprights to discharge contents through gate into tubs on second scaffold level. Uprights are adjusted backward a few degrees to balance load.

Effect on Progress and Safety—By the use of power lift trucks the entire bricklaying operation was speeded up considerably over the usual method. Principally because less scaffolding had to be moved from floor to floor for use in the high story areas, continuous operation with the maximum number of bricklayers was possible in each section. The contractor always was able to dismantle the scaffold on one floor and have it ready for workmen on the next floor without increasing the number of scaffold men or slowing down any of the brickwork.

Supervision — William T. Power, superintendent was in charge of the work for the George F. Driscoll Co. Operations of the bricklaying crew and of the high-lift truck were directed by James Gilmartin. Jack Stenstrom supervised the loading of pallets, mortar pans and skid platforms and the delivery of skids to the hoist on the first floor.

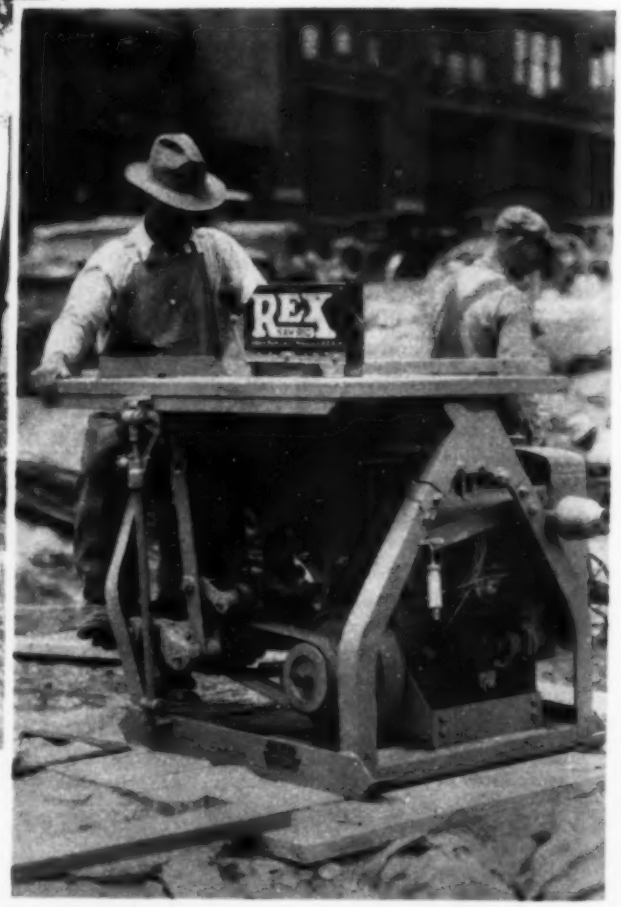
NEW EQUIPMENT *on the Job*

If You Want Further Information—

Within the space limits of this page it is impossible to present complete information about the products illustrated.

The manufacturers, however, will be glad to supply further details if you will write to them.

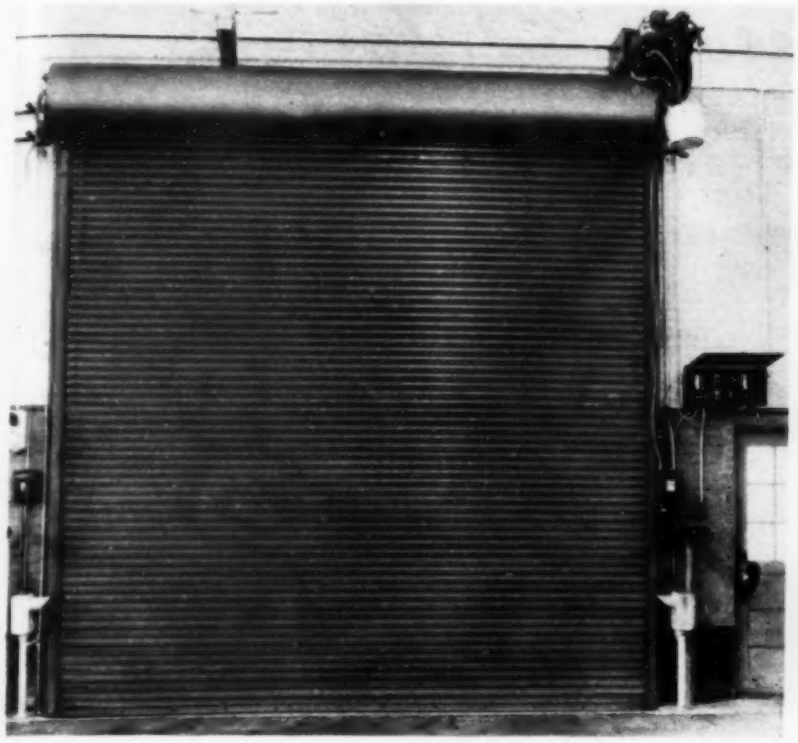
PORTABLE BALL-BEARING SAW RIG ***(below)*** **equipped with straight-line cutoff, adjustable arbor shaft and tilting table can do ripping, cross cutting, dadoing, mitring, bevel cross-cutting, double mitring and bevel ripping. Standard driving equipment is 10-hp. four-cylinder gasoline engine, with crankshaft turning on ball bearings, but electric-motor drive may be obtained. Light, welded steel frame. Width only 28 in. Abrasive disk may be substituted for saw blade to cut and mark tile, concrete products and similar materials.—Chain Belt Co., Milwaukee, Wis.**

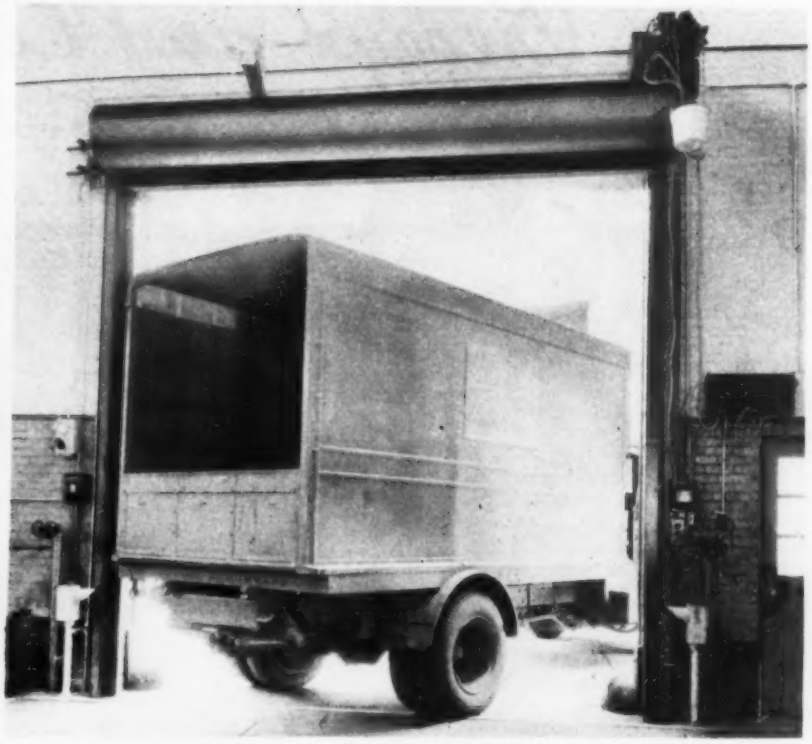


AMPLE RESERVE POWER in new tractor ***(below)*** which develops 48.6 drawbar hp. at low speed of 2.08 m.p.h. and has high speed of 4.5 m.p.h. Track shoes, 15 in. wide; total track surface in contact with ground, 2,010 in.; weight of tractor, 11,000 lb.; ground pressure per square inch, 5.27 lb. Drawbar pull at low speed, 8,750 lb. Drawbar designed to stand heavy blows of direct-hitch 7- or 8-yd. wagon. Bar also has wide swing which reduces side draft in pulling blade grader. Engine is equipped with inserted valve seats of special steel possessing high-resistance to heat.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

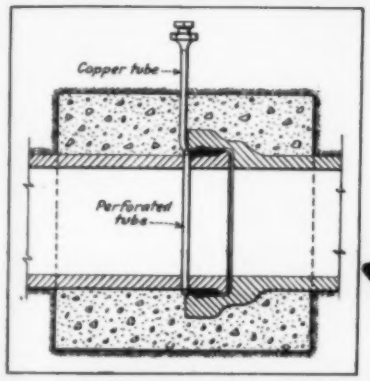
TRACTOR-DERRICK ATTACHMENT ***(below)*** **of welded steel construction operated by double-drum control unit powered from tractor engine has maximum lifting capacity of 10,000 lb. All sheaves turn on Hyatt roller bearings. Boom can be detached from derrick frame by removing two hinge pins, and entire derrick, including frame, can be dismounted in 20 min. by loosening six bolts. To remount, tractor is driven under frame on blocks and bolts are reinserted. Tractor can be used for hauling, bulldozing, and other operations while derrick is mounted on it.— R. G. LeTourneau, Inc., Stockton, Calif.**

TRAILER RAIL-CAR WELDING MACHINE equipped with derailing device can be removed readily from track by one man. Four transverse double-flanged wheels are swung through short arc by hand-operated gearing and shafting until they come in contact with cross rails and raise entire car sufficiently to clear wheel flanges. Car carries FlexArc 300-amp. welding generator and auxiliary generator rated at 7½ kw., 125 v., coupled to six-cylinder engine. Auxiliary generator supplies excitation current and power for grinders, slotters, other tools and lights. Machine is designed especially for railroad maintenance work. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

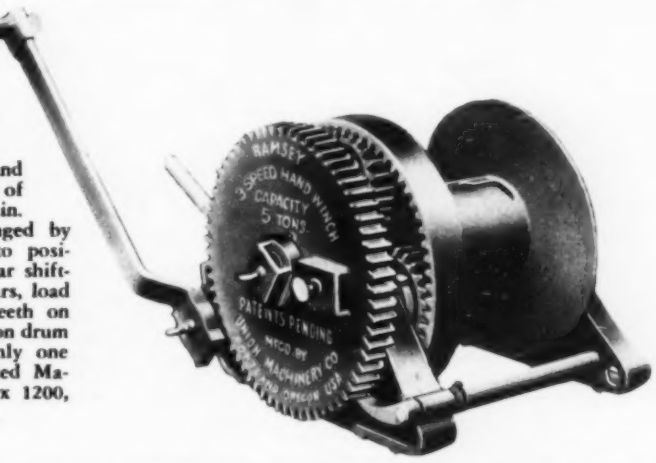




"ELECTRIC-EYE" CONTROL automatically opens and closes large garage doors. One light beam, projected diagonally from floor to photo-electric cell above door *(left)*, is intercepted by approaching truck, causing door to open. Second light beam, at door opening *(right)*, holds door in open position until beam is vacated by truck, when door closes immediately. Traffic signal lights are incorporated to indicate when doors are open. Device saves time, conserves heat in winter, and removes danger of collision.—The Stanley Works, New Britain, Conn.



TO SEAL LEAKING PIPE LINES, perforated copper tube is installed around leaking pipe or joint and embedded in thick concrete shell. Leak-proof emulsion then is injected by pressure gun through perforations into concrete barricade, thoroughly impregnating concrete for ample distance around leak. Emulsion reacts to form insoluble salts which plug pores in concrete. Antileke pipe joint eliminates sealing clamps and necessity of shutting down or reducing pressure during repairs. Used on gas, oil, and water lines. Seals have tested up to 1,500 lb. per square inch.—Gas & Electric Facilities, Ltd., 447 Sutter St., San Francisco.

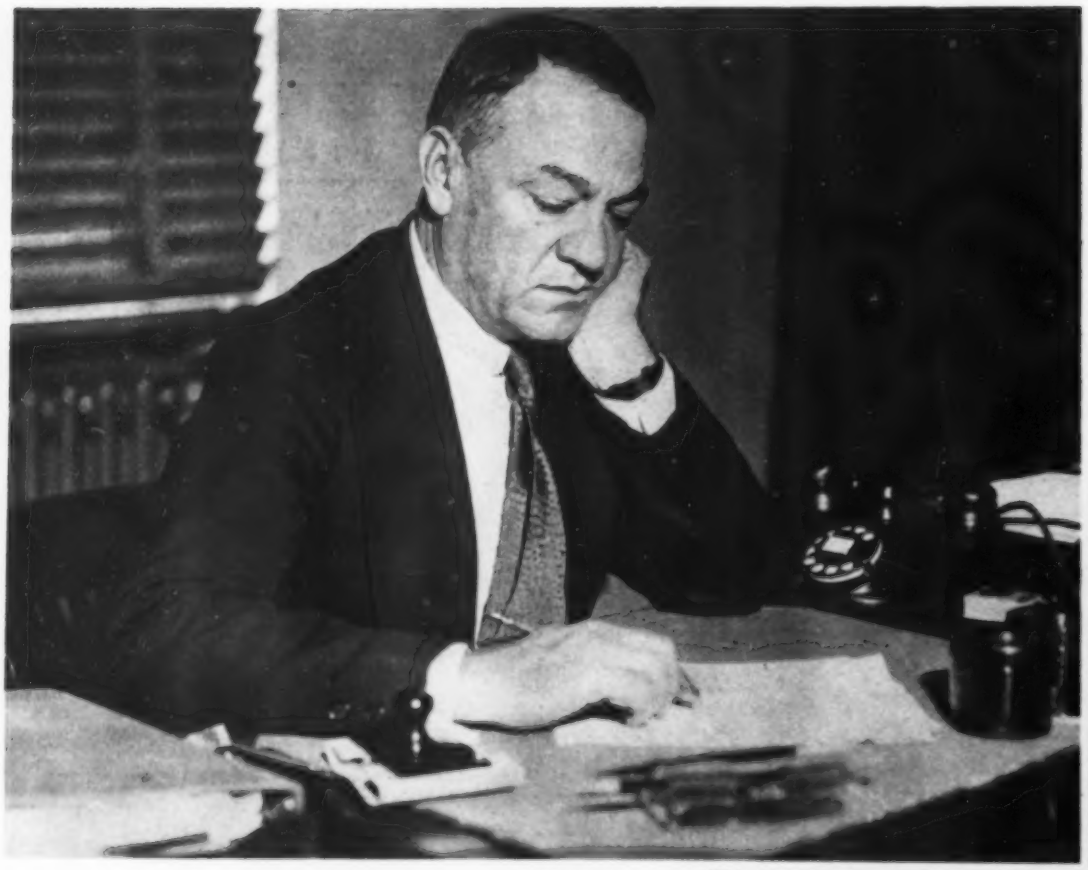


COMPACT THREE-SPEED HAND WINCH *(right)* weighing 150 lb. has capacity of 10,000 lb. at 25 to 1 ratio and 1,500 lb. at 4 to 1 ratio. Drum of Ramsey unit holds 200 ft. of 5/8-in. cable. Speed is changed by moving hand crank to positions provided—no gear shifting. In final drive gears, load is applied to three teeth on pinion and three teeth on drum gear instead of to only one tooth on each.—United Machinery Co., P. O. Box 1200, Portland, Ore.

CLUTCH-TYPE CONVERTIBLE EXCAVATORS *(below)* have primary power unit, either gasoline, diesel, or electric, connected through master clutch and speed reducing mechanism to main machinery. Hoisting, traveling, swinging, booming, and crowding are controlled through independent external-contracting-band friction clutches. Excavators can be converted speedily on job to dragline, crane, clamshell, or trench shovel. Chain-driven self-cleaning crawlers. Main lower frame is one steel casting. One-piece cast-steel swing gear bolted and doweled to lower frame casting. Roller circle has load applied to top and bottom, as in roller bearing, reducing load on shafts to minimum and distributing weight over number of rollers.—Marion Steam Shovel Co., Marion, Ohio.

Present and Accounted For —

A Page of Personalities



Wide World Photo

INDUSTRIAL ADMINISTRATOR. Immediately after signing the National Industrial Recovery Act last month, President Roosevelt appointed Brigadier General Hugh S. Johnson *(left)*, U. S. Army (retired) to administer the far-reaching recovery program. His major responsibilities will be to stimulate employment and induce united action between labor and management under codes of fair competitive practice, covering maximum hours of work and minimum wage scales. General Johnson, a native of Ft. Scott, Kan., is a West Point graduate (1903) and during the World War originated the plan for the selective draft, for which he received the Distinguished Service Medal, and later served as chief of the Purchase and Supply Bureau of the War Industries Board. He resigned from the military service in 1919 to become general counsel and assistant general manager of the Moline (Ill.) Plow Co. During recent years he has been a business associate of Bernard M. Baruch, of New York.

International Photo

PUBLIC WORKS ADMINISTRATOR. By executive order of the President last month Col. Donald H. Sawyer *(right)* was appointed "to exercise temporarily the office of Federal Emergency Administrator of Public Works" under the National Industrial Recovery Act. Col. Sawyer has been director of the Federal Employment Stabilization Board at Washington, D. C., since 1931 and was formerly secretary of the Associated General Contractors of America. During the World War he served in the Construction Division of the army and later was employed by James Stewart & Co., New York contractors.

GLEN D. MACY is the newly appointed state highway engineer of New Mexico. He was formerly assistant state highway engineer and district engineer and, later, construction superintendent for Bert Brooks, contractor.

JAMES W. CAREY *(below)*, of Seattle, has been named chief engineer of the Department of Public Works of Washington. He was a member of the firm of Carey & Harlin, rate and valuation consultants.

MERTON R. KEEFE has been appointed chief engineer of the Indiana Highway Commission. He was formerly vice-president of Ulen & Co., contractors, of Lebanon, Ind

BEAR·CAT·JR SHOVEL

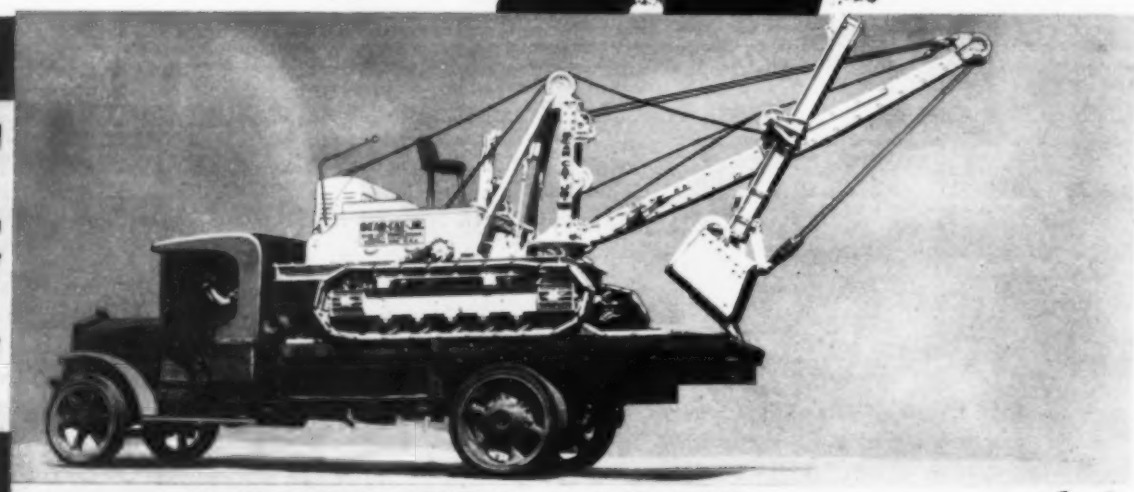
"THAT'S what we need!"

• speed

2 operating speeds for hard or soft digging and

3 propelling speeds, with a high speed of 4 miles per hour.

Or move it at 25 miles per hour by truck or trailer.

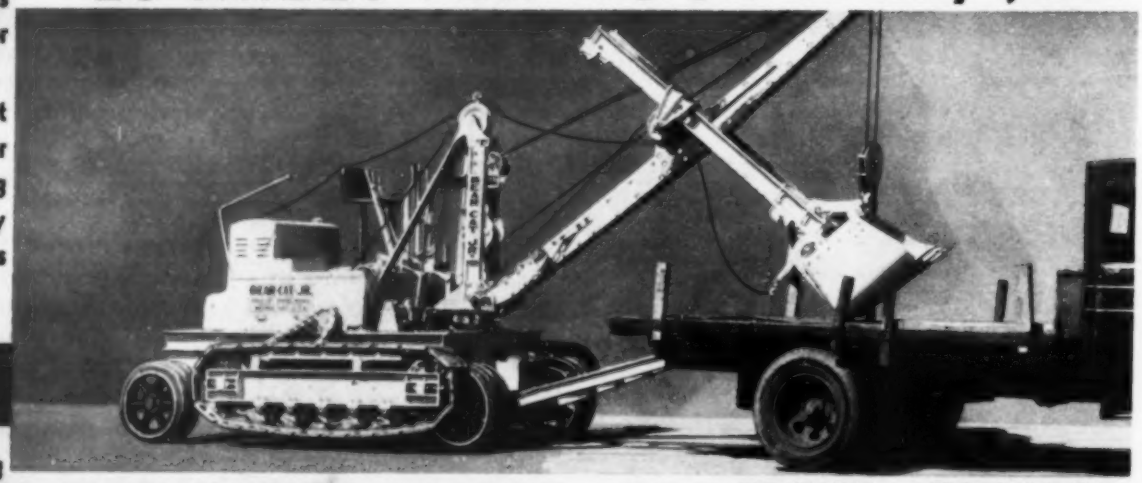


25 MILES PER HOUR to any job!

• extra profit

A low moving cost increases profits on all jobs large or small - -

You can move the Bear Cat Jr. anywhere in the city or county and have your digging job done before a big clumsy shovel gets started on its way.



• low cost

It will dig dirt all day long on 10 gallons of gas and ¼ pint of oil.

The Bear Cat Jr. is the lowest priced shovel . . . the biggest shovel value . . . in the world today!!

100% PORTABLE ON TRUCK ▲ TRAILER ▲ CRAWLER ▲

SEND FOR FREE BOOK ! **This 24-page illustrated book, "How to Dig Dirt at Lower Cost," is yours for the asking . . . send for it now!**

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THE WORLD'S BIGGEST SHOVEL VALUE!

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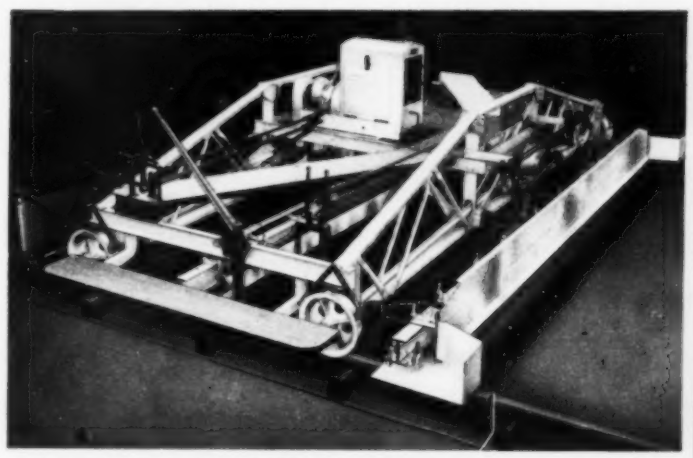
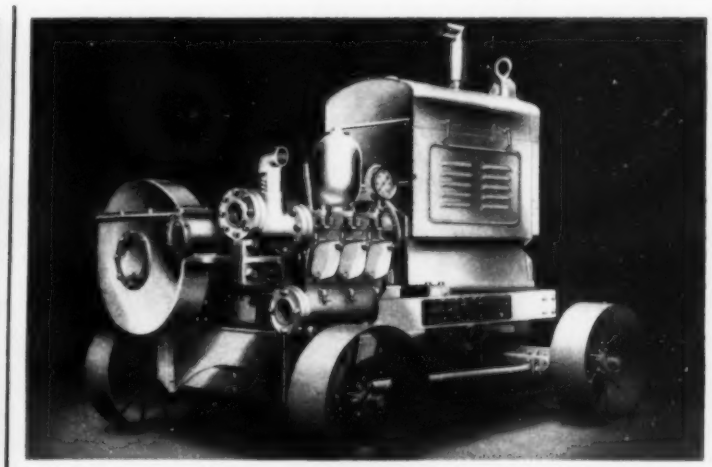
TRUCK MIXERS, to 5 cu.yd. sizes, end or side discharge, for commercial concrete and road building (concrete and secondary bituminous).

CONCRETE SPREADER, the modern, low cost method for slab and widening work.

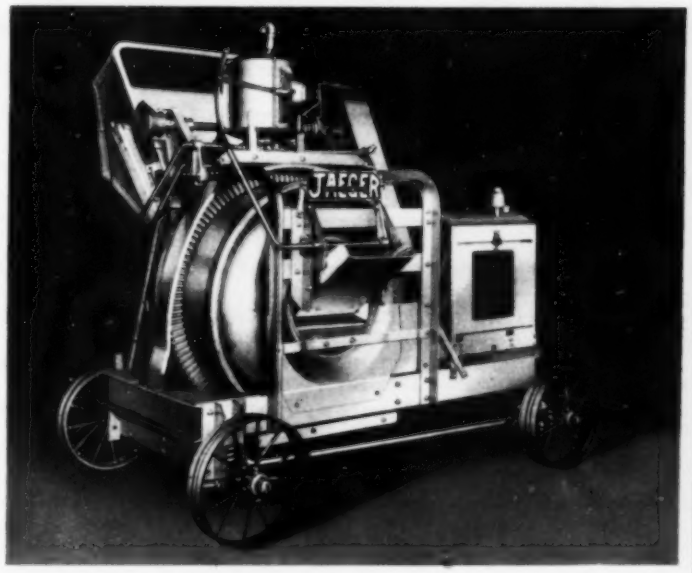
Jaeger Equips You for New Day Jobs



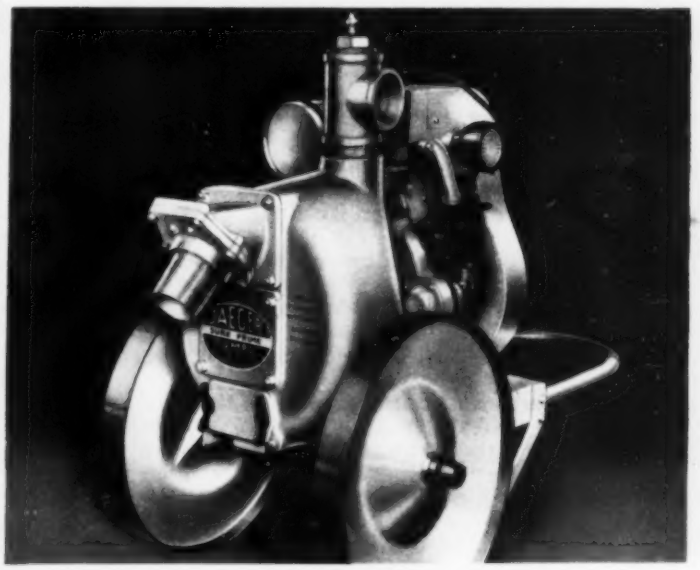
1934 MODEL "HYDRO-LIFT" FINISHERS
Higher speed, greater capacity, either side or center controls.



HEAVY DUTY TRIPLEX ROAD PUMPS
Years ahead of the field in construction and performance.



BRIDGE BUILDERS' MIXERS (3½S to 28S)
With Syphon Type Water Regulator accurate within ½ pint



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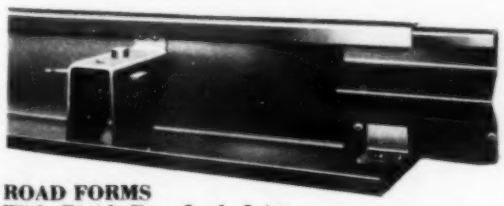
$165 buys 10,000 gallon, 2" size with 2½ H.P. engine.



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SINCLAIR WINS NAVY OIL AWARD for 3rd successive year

The United States Government has just awarded to Sinclair for the third successive year the larger part of the annual contract for supplying lubricants to the Navy and other Government Departments. This includes not only the oils for all battleships, submarines, destroyers and Navy airplanes on the Atlantic seaboard—but also the oils for motor cars, trucks, tractors, machine shops and other equipment operated by important Government departments in thirty-six states.

The Government received proposals from various oil companies. Both quality and price were considered in making the formal award which is based on the lowest service cost per gallon. Sinclair has also received an award from the War Department covering 231,800 gallons of Sinclair Aircraft Oil to be used in United States Army Air Corps equipment.

Sinclair Engineering service is at your command. Call or write our nearest branch office or any local Sinclair Agency. Sinclair Refining Company (Inc.), New York, Atlanta, Chicago, Houston, Fort Worth, Kansas City. Sinclair Refining Company of California, Los Angeles.

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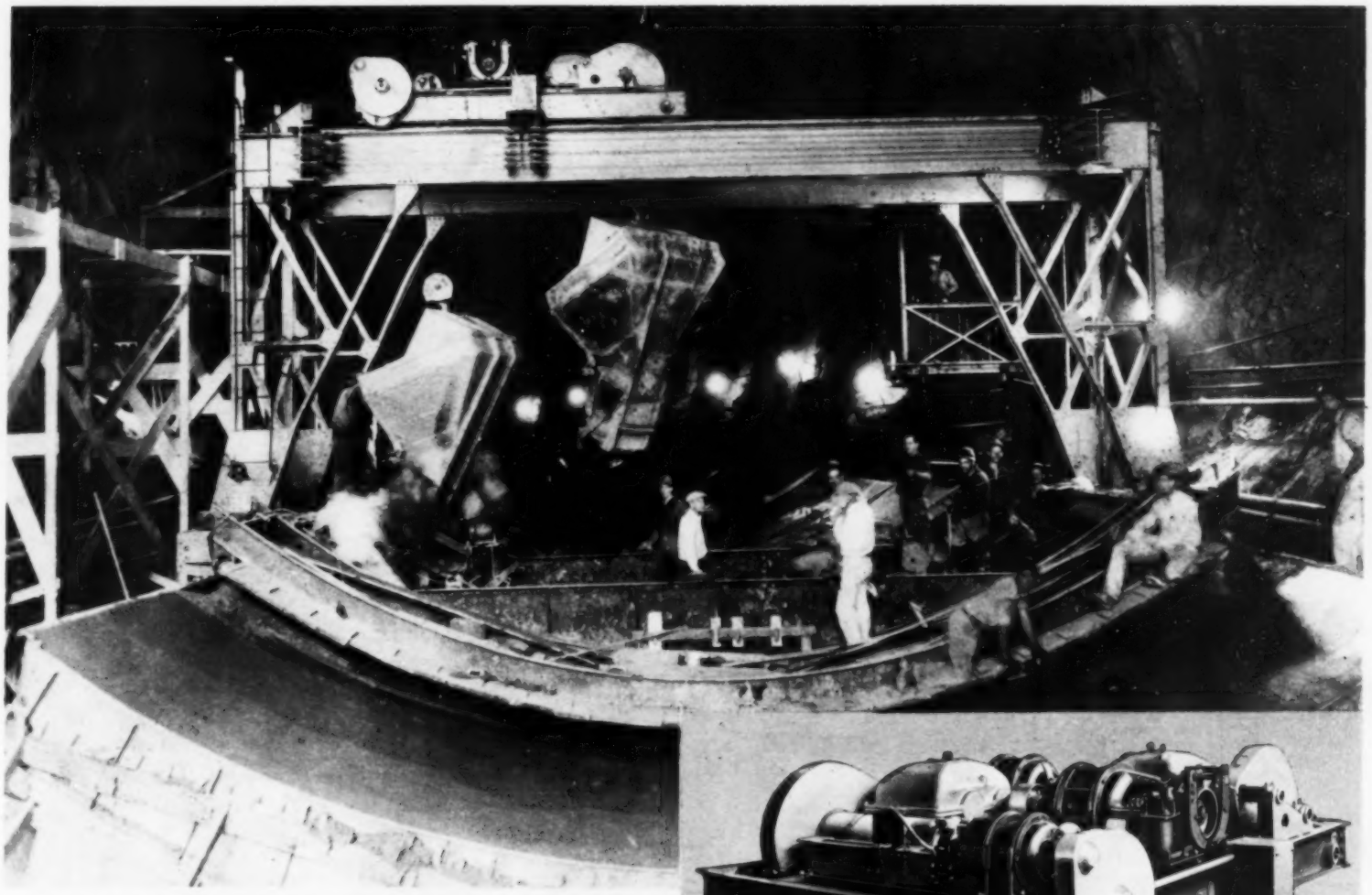
SINCLAIR

INDUSTRIAL OILS GREASES



The trolley of this Shepard-Niles gantry crane is equipped with dependable G-E motors and with safe, smooth, Thrustor-operated brakes

AT BOULDER DAM

G-E Equipped Gantry

Cranes Handle 2300 cu. yd. of Concrete a Day

LINING the Boulder Dam diversion tunnels at the rate of 2300 cu.yd. of concrete a day, for weeks at a time, was accomplished with the help of G-E equipped gantry cranes similar to the one illustrated above.

All of the "mix" for this job was delivered by truck from a central plant, and then was picked up and deposited in the invert section and side-wall forms by the gantry cranes. The G-E motors and control and the Thrustor-operated brakes with which each crane trolley was equipped, were important factors in assuring speedy, reliable, and economical operation.

On your jobs, too, G-E motorized construcion equipment will provide similar advantages. The reasons: Correct design, careful manufacture, and thorough testing assure efficient, durable apparatus; nation-wide G-E engineering and service organizations assist on problems of installation and maintenance; and conveniently located warehouses and branch offices facilitate prompt shipment.

Whatever your electrical needs—motors, control, Thrustor-operated valves and brakes, wire and cable, conduit fittings, etc.—a G-E specialist will be glad to aid you. Through him you can get all the electric apparatus for your jobs. Why not get in touch with him to-day? Address the nearest G-E office, or General Electric, Dept. 6-201, Schenectady, N. Y.

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GENERAL ELECTRIC

GREATER PROFITS, MORE YARDAGE AT LOWER COSTS

10% GREATER YARDAGE

OVER 50% FUEL ECONOMY

TWO WAYS to greater profits are offered by the Lorain 75-B powered with the "Caterpillar" Diesel. A year of thorough testing, in factory and field, has demonstrated these qualities of the unit.

OPERATING costs are reduced, increasing the margin between bid prices and costs. The motor uses low-priced fuel only, requiring about one half the gallonage of higher-priced gasoline. Reductions over gasoline costs often exceed 50%.

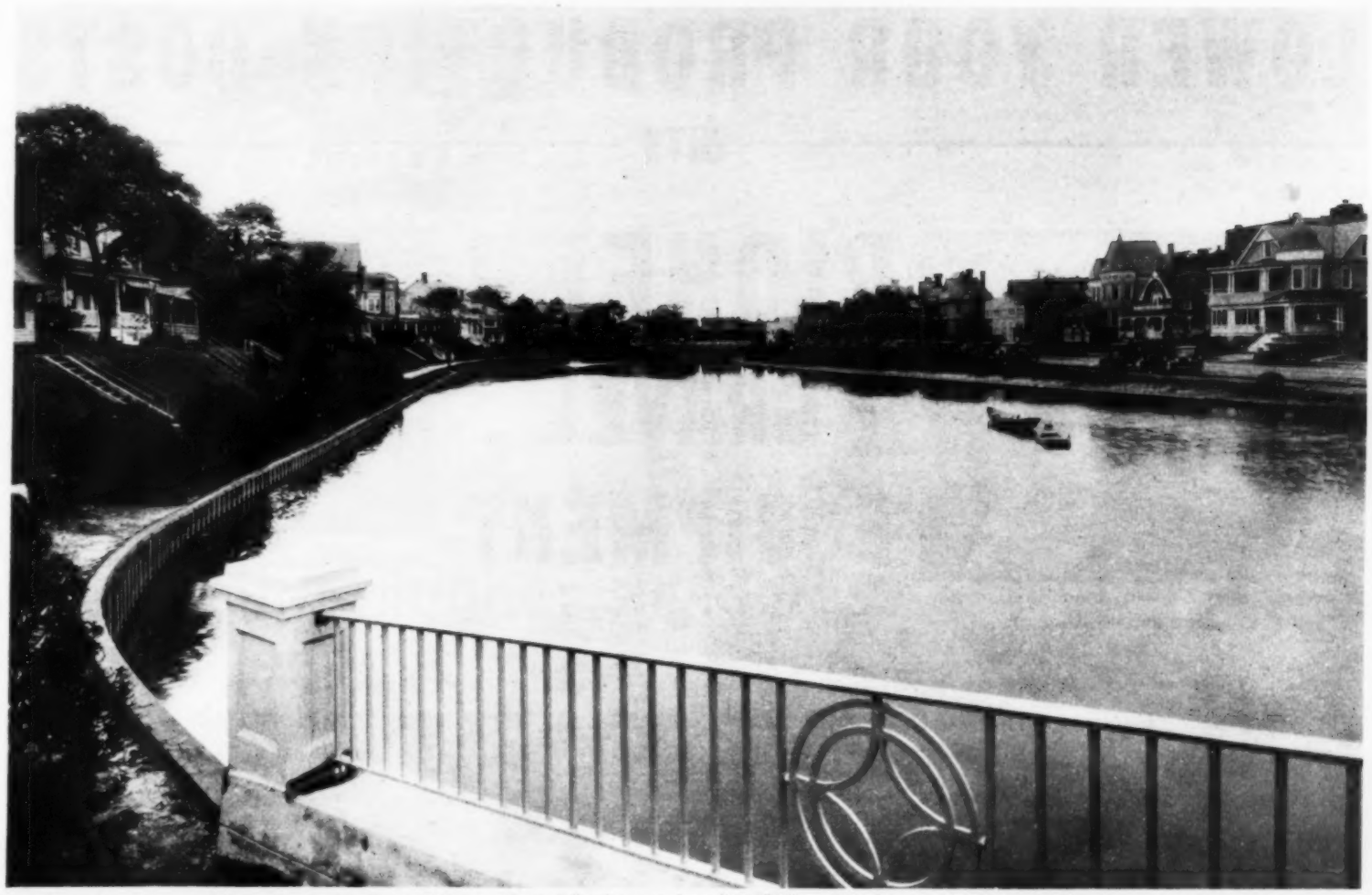
THEW CENTER DRIVE

INCOME is increased because the digging characteristics of the improved Diesel, plus the power efficiency of Thew Center Drive yield a potential increase in yardage of 10%. More yardage at lower costs make bigger profits inevitable.

THE THEW SHOVEL CO., LORAIN, OHIO

"CATERPILLAR" DIESEL

LORAIN 75B



Wesley Lake, between Asbury Park, N. J., and Ocean Grove, showing portion of Bethlehem (Lackawanna) Piling bulkhead. Fred McDowell, contractor.

"Rebuilding" a Lake with Bethlehem (Lackawanna) Piling

Improvements completed at Wesley Lake, between Asbury Park, N. J., and Ocean Grove, offer an interesting example of the use of Bethlehem (Lackawanna) Piling.

The project consisted chiefly in the reclamation of the shores through the installation of steel-piling bulkheads totalling about 4400 ft. in length. In place of irregular shores, sloping gradually from the adjoining properties to the bed of the lake, the lake is now bounded by a neat, clean-cut wall of steel, allowing the borders to be attractively landscaped and planted.

The bulkheads were constructed of Bethlehem (Lackawanna) Steel Sheet Piling. 563 tons of piling were used. For greater resistance to corrosion the piling was made of copper-bearing steel and given a coat of paint.

Bethlehem (Lackawanna) Section AP-16 was chosen for this job because its reversible interlock allows all webs to be in the same vertical plane, forming a neat, smooth-surfaced piling wall. Six-inch channels, which formed the coping, were bent to the required contours on the job by means of specially-designed clamps and jacks.

This is but one of numerous projects where the use of Bethlehem (Lackawanna) Piling offered the economical, practicable way of meeting the problems involved. Our piling engineers, experienced in the application of steel-sheet piling to jobs covering a very wide range of conditions, will be glad to study your project and submit recommendations.

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LOWER YOUR PRODUCTION COSTS

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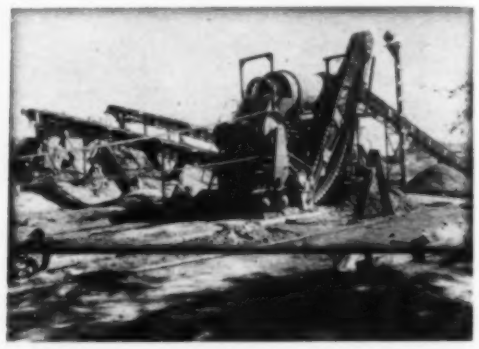
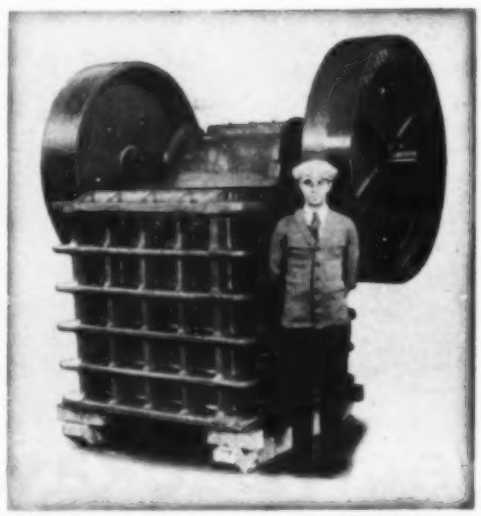
Pioneer Trailer Duplex. A one unit screening, crushing and loading plant.



The 300W Washing Plant—portable for wayside production of washed aggregate. Capacity 150 tons per hour input.

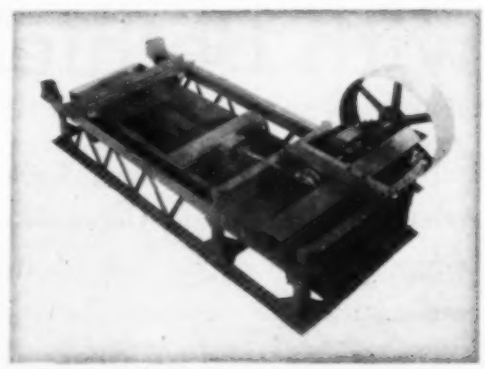
Pioneer 44WR. The smaller capacity washing plant. Factory built for roadside production.



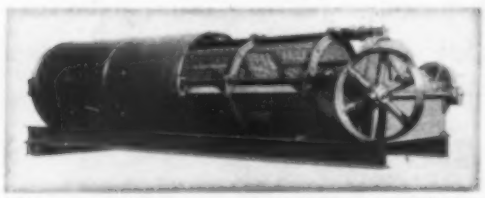
The New 2436 Primary Jaw Crusher. Pioneer builds a complete line of bronze and anti-friction bearing crushers.

Producing four sizes of aggregate with *Pioneer 300W Washing Plant.*

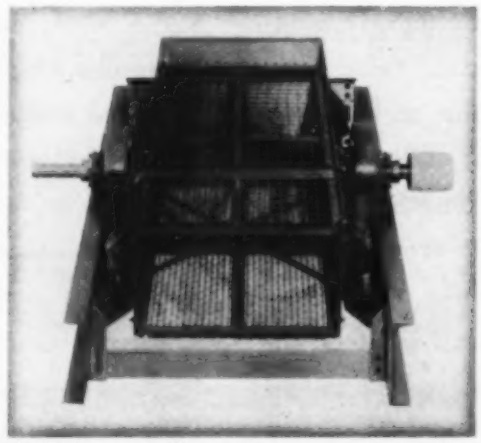
The New 1933 *Pioneer No. 12B Duplex* for economical production of small aggregate.



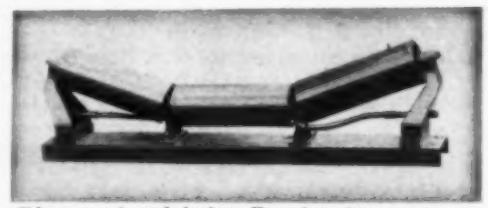
The No. 5 Shaker Screen. A new addition to the Pioneer line. Shaker Pan 40"x10'.



Pioneer makes a complete line of *Revolving Screens* and *Scrubbers.*



The Pioneer Vibrator Screen—with perfect balance built-in.



Pioneer Anti-friction Bearing Conveyors are made in following widths, 18", 24" and 30".

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not all Crawler tractors are CLETRACS

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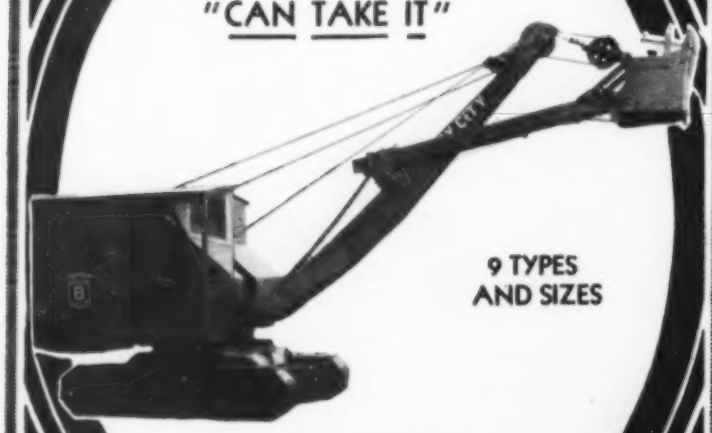

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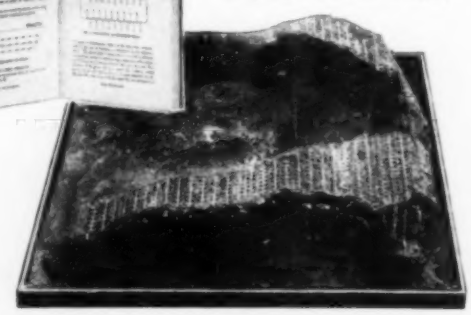

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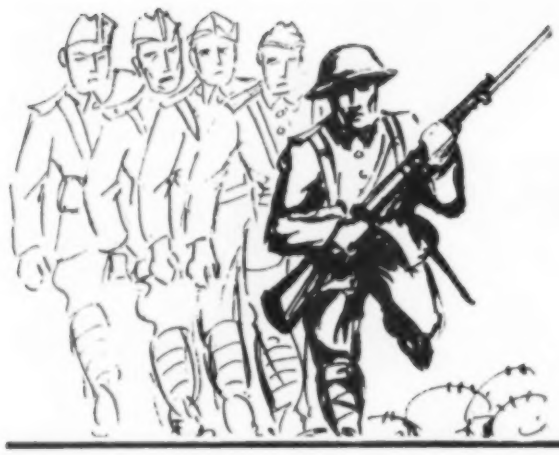


The men BEHIND the

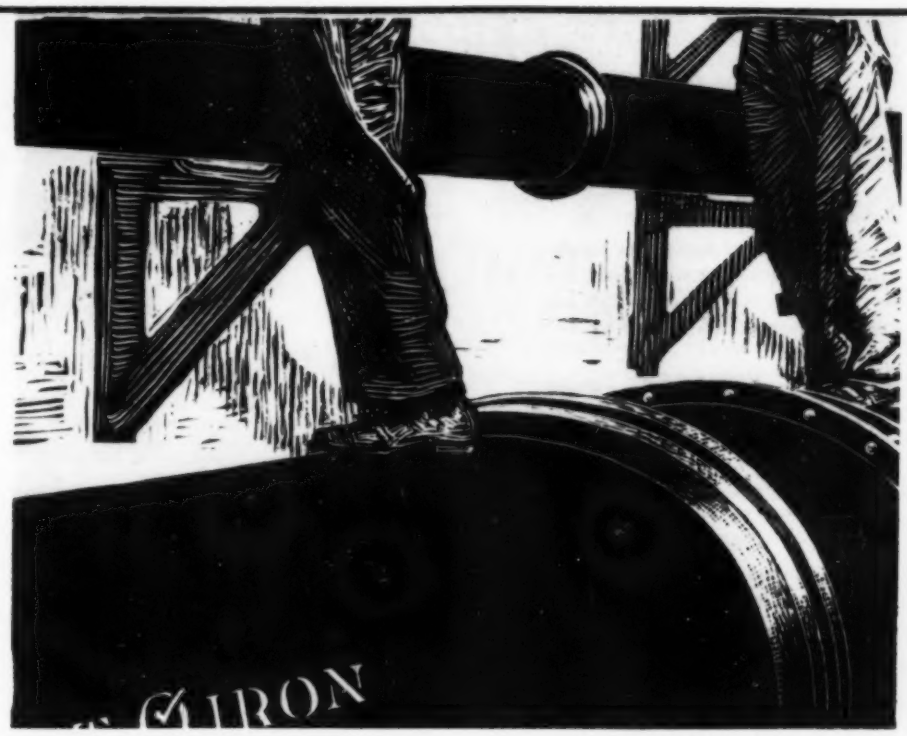
ILLUSTRATING HOW PUBLIC CONSTRUCTION INCREASES EMPLOYMENT INSIDE AND OUTSIDE THE INDUSTRY

In the late war four men were required in the rear to support every man at the front. Behind the men in the rear was the whole industrial structure of the United States, employing millions.

The engineering-construction industry provides comparable employment estimates. In normal times 3,000,000 people are employed directly in construction work. 83% of the construction dollar goes to these employees and to employees in other industries.

Different authorities agree in their estimates of the indirect benefits of a sustained program of construction: (1) that every billion dollars expended by the government for public works will provide employment directly and indirectly for one million men; (2) that for every man actually at work in the front lines of construction there are three to four behind him, making and transporting equipment and materials. This ratio has been established in highway construction. A single item, cast iron pipe, used extensively in water-works construction, provides employment in seven industries — coal mines, iron mines, limestone quarries, pipe foundries, blast furnaces, trucking and railway transportation. Water-works authorities estimate that it will require one million men a full month's time to produce and lay the cast iron pipe necessary to complete water-works improvements now on the project list.

e man BEHIND the gun

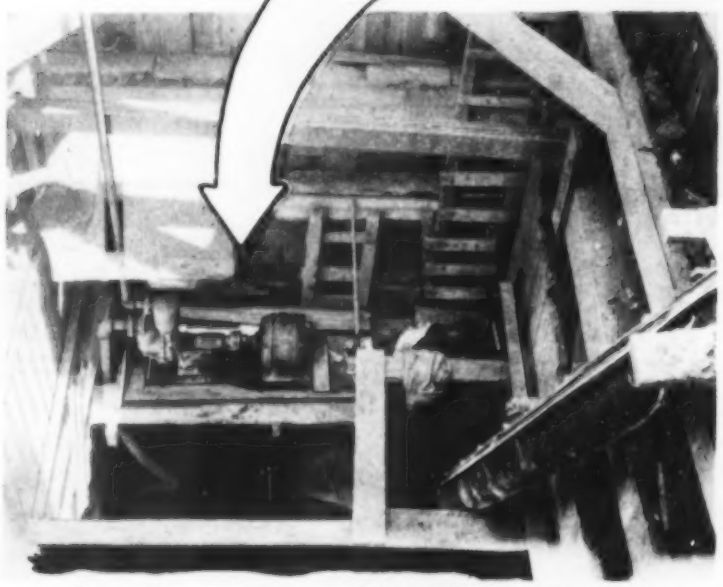


Courtesy of United States Pipe and Foundry Co.

The engineering-construction industry, comprising 45,000 engineers and contractors, has been entrusted with the responsibility of accelerating this employment as Washington releases the $3,000,000,000 of finances. No one can foresee which engineers, which contractors will get the jobs. Nor is it economically feasible to contact all these engineers and contractors one by one with salesmen. There is a definite, effective way for manufacturers of equipment and materials to do the job — and that is with steady two-fisted advertising in

Engineering News-Record
Construction Methods
McGraw-Hill Publications
330 West 42nd Street **New York**

4 pumps failed on this job



Four other pumps unsuccessfully tackled this job in Brighton, Mass., before the contractors, P. DeCristofaro, Inc., put a LaBour to work and thus ended their difficulties. The job was the high level sewer in Fremont Street, under the Metropolitan District Commission.

As the photograph shows, there was considerable suction lift required, and the total head was 35 feet. One pump, guaranteed to deliver 150 g.p.m., delivered only 35, according to the contractor. Another worked fairly well at first, but failed completely within a few days. None of the four delivered satisfactory or even sufficient performance, and all required unceasing attention at short intervals.

When the LaBour was put in it started to do the job at once and continued to do so without attention. The LaBour, *of the same rate capacity as the others*, kept the water down by running two hours a day; all the others had run almost continuously. The LaBour was started by a switch from the top of the shaft; the others required priming "adjustment" at the pump when starting.

According to this contractor, $300 or more would have been saved had the LaBour been installed in the first place. You, too, can avoid expense and delay by installing a LaBour first. Other pumps may save a few dollars in first cost, but they are usually expensive before you are through with them. Whenever there is a real show-down LaBour delivers—and that's the important thing to your pocketbook.

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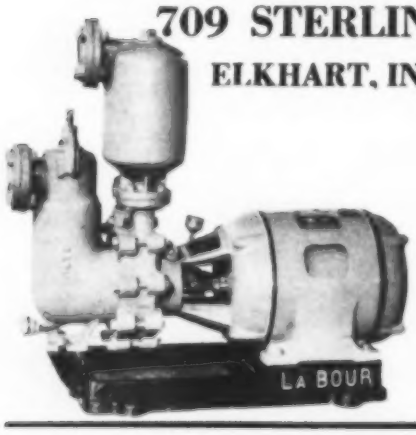

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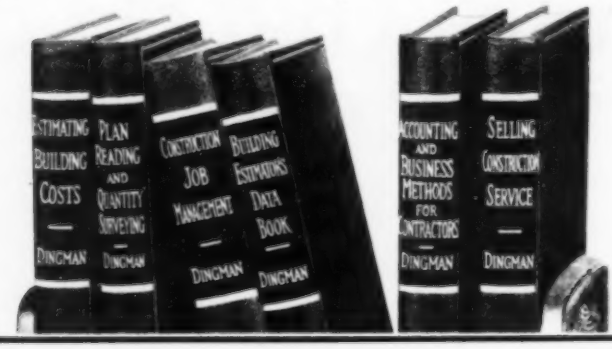
"Construction has been selected as the activating force in the nation's plan for industrial recovery . . . All indications lead to the conviction that the administration at Washington will not temporize in getting construction work started."

***—from an editorial in* CONSTRUCTION METHODS.**

Now that the awakening is at hand—the old questions come up again. What are you going to do to make up for months lost marking time? What can you do to improve your business or to advance yourself?

Here is a library of books that innumerable men have used in the past to answer these very questions. An invaluable reference source for the contractor or superintendent who wants the best time-and-cost-saving methods for getting things done. A complete study course for the young man who knows that experience is a great teacher but that he can learn more, quicker and cheaper, from books. Look them over. In many ways they can help you get the jump on opportunities and activity that the New Deal is Bringing.



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This library is intended for

(1) The building contractor who wants a handy reference set that will give him almost instantly a ready answer to most of the problems that come up in the course of the day's work.

(2) The young men in the building industry who intend to make the business of construction their life work, and who want the kind of guidance that will aid them to climb to the top.

(3) Everyone in the building industry who wants to keep his job by increasing his usefulness and efficiency.

Each one of the volumes in this set is a complete handbook on some important subject. Sturdily bound and pocket size, it will go right "on the job" with you for immediate consultation.

Practical data is given on analyzing a construction job into its component parts—estimating the costs of labor, haulage, equipment, materials, etc.—plan reading and determining quantities from specifications—personnel management—successful supervision of every building operation—efficient and economical business methods—office procedure such as accounting, banking, purchasing, etc.—advertising and selling methods for contracting service—and a complete data book of tables, forms and calculations most frequently used by the builder.

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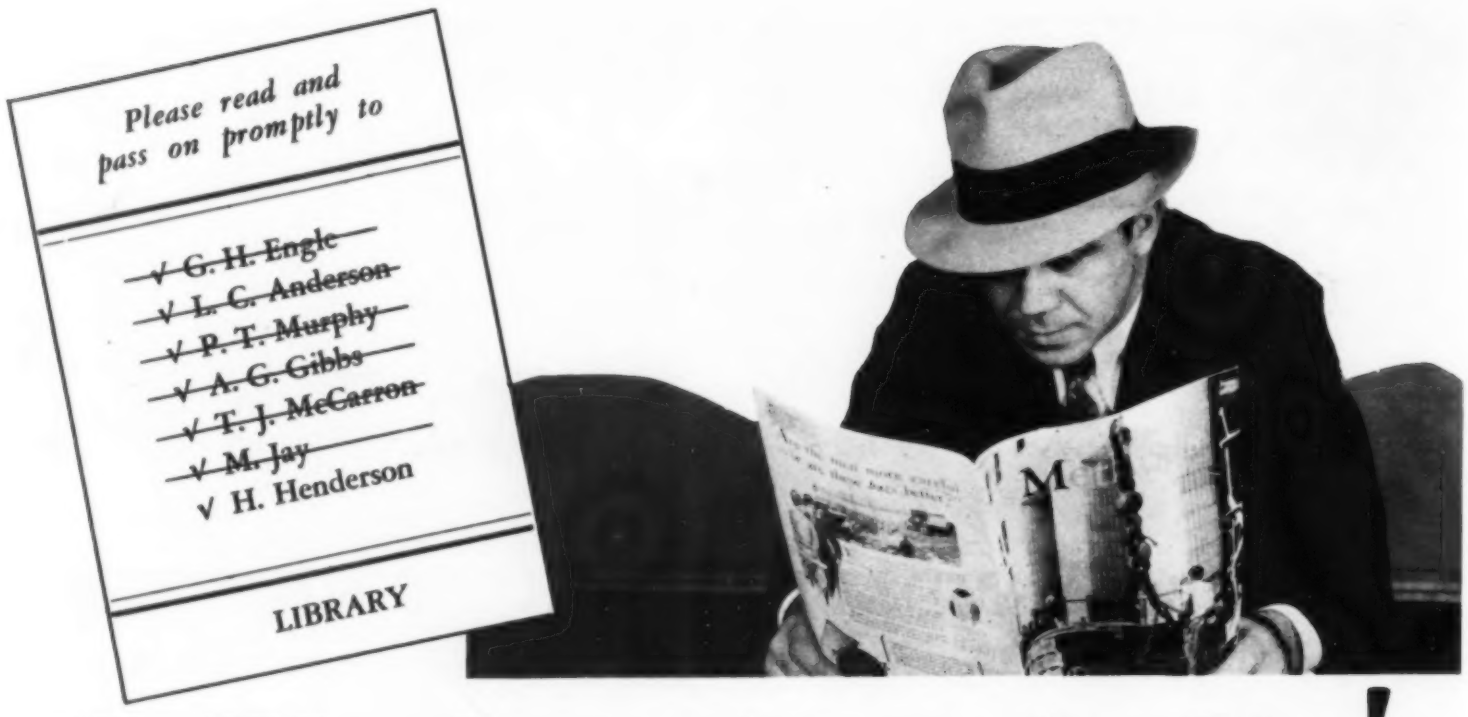

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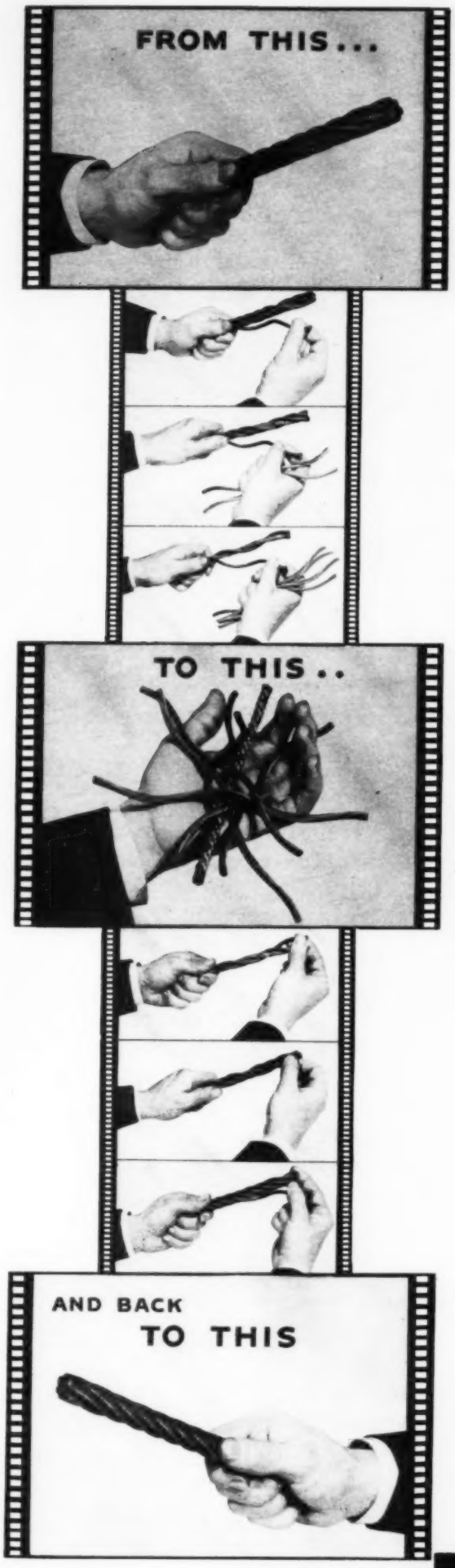
SEARCHLIGHT SECTION



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